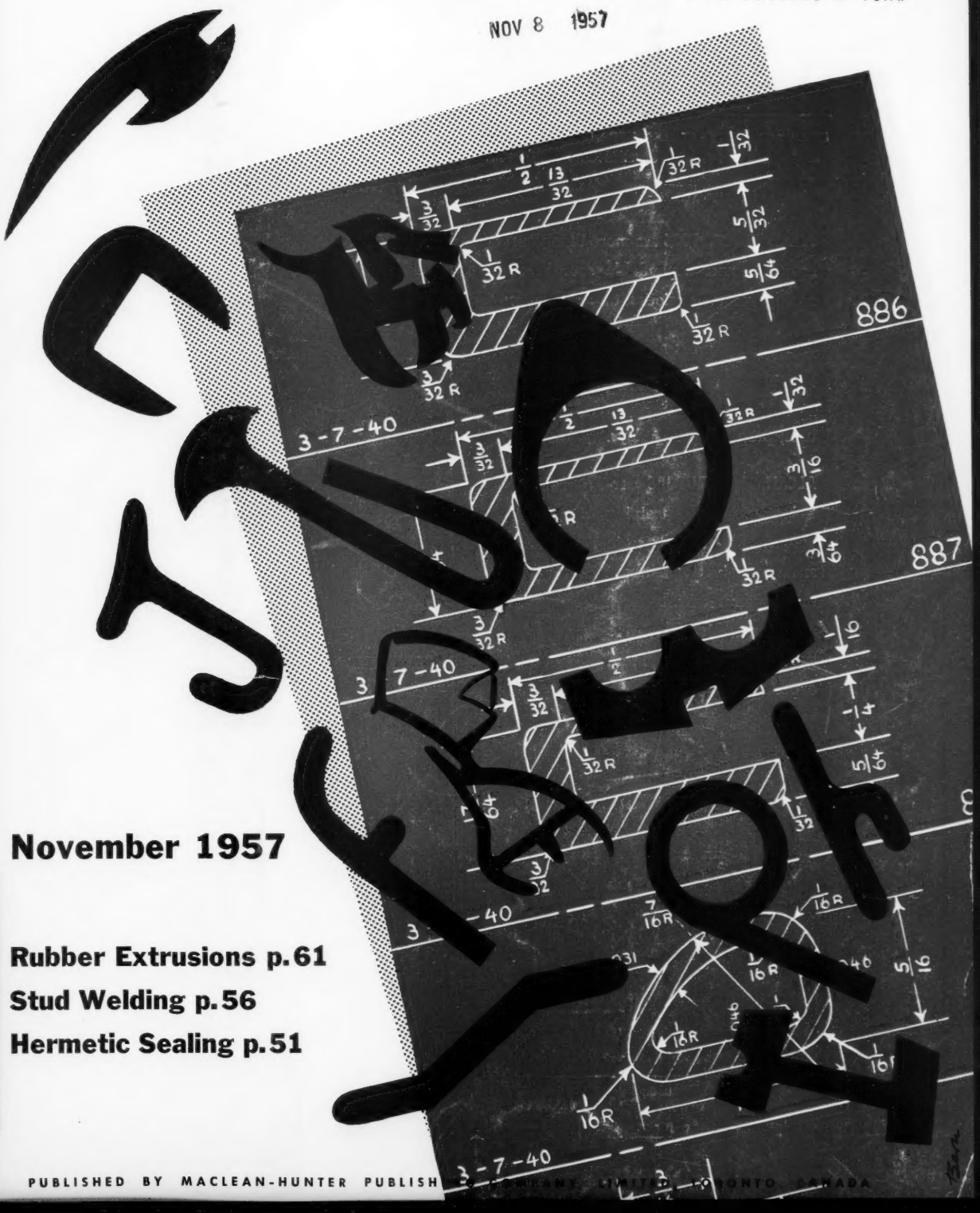
Design Engineering

FIVE DOLLARS A YEAR

NOV 8 1957



November 1957

Rubber Extrusions p.61
Stud Welding p.56
Hermetic Sealing p.51

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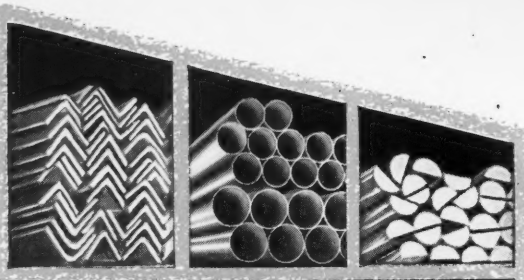
THEY KNOW



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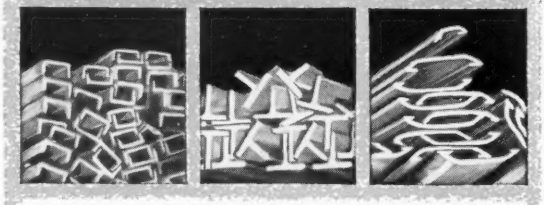

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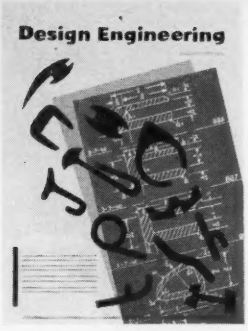

This month's cover

Gerald Bern makes a very welcome return with his attractive cover showing some of the hundreds of extrusion shapes that are possible.

As the article explains, the process of extruding is one of the oldest methods used in manufacturing rubber products. It can be used with equal success for producing items from natural rubber, synthetic rubber, plastic and reclaimed rubber.

Design Engineering

MEMBER

CCAB

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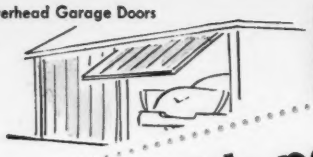
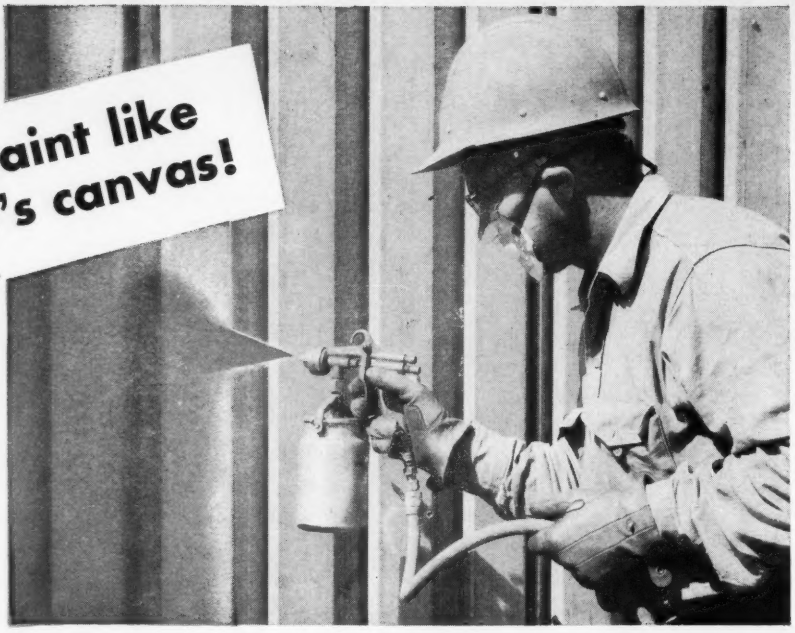
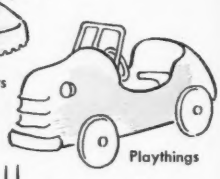


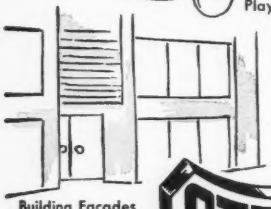
Holds paint like an artist's canvas!



Lawn Mowers



Playthings



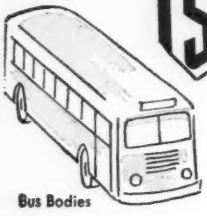
Building Facades

STELCO

"COLOURBOND"

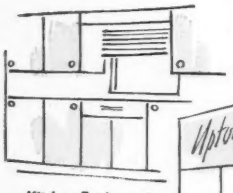
CONTINUOUS

GALVANIZED STEEL SHEETS



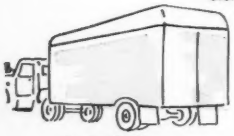
Bus Bodies

Utility Tables



Kitchen Equipment

Store Fronts

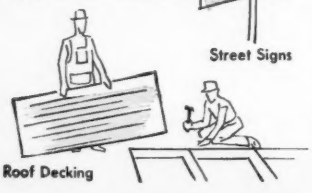


Trailer Bodies

Picnic Coolers

Fishing Tackle and Tool Boxes

Street Signs



Roof Decking

The coating of pure zinc on Stelco's new "Colourbond" Continuous Galvanized Steel Sheets is applied by an exclusive technique developed by Stelco . . . it produces a soft lustre finish, perfectly suited to the close adhesion of paint and particularly acceptable when a bright surface spangle is not desirable.

No surface preparation is necessary, and no primer coat needed.

As with all other galvanized sheets produced by Stelco's patented continuous galvanizing process, the bond between the zinc and the steel is so tight that the sheets can be worked or formed to the limits of the base steel itself, without any sign of cracking or peeling of the zinc coating.

For every product or building application where a painted surface is required to combine with an anti-rust, anti-corrosion surface use Stelco "Colourbond" Galvanized Steel Sheets — available now, in sheets or coils.

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Inside

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The article on molded and extruded parts was written by **C. D. Jacobs,** manager of automotive, aircraft, molded and extruded parts of B. F. Goodrich Canada Limited, Kitchener, Ontario. Mr. Jacobs started with B. F. Goodrich in 1926 as a messenger boy and worked progressively through various office responsibilities, including tire distribution and control and operating manager of the company's newly created industrial products division. Prior to his present responsibilities, which were assigned in 1945, he was in field sales.

J. H. Marsh Jr., vice-president in charge of sales, Fusite Corporation, authored the article on hermetic sealing.

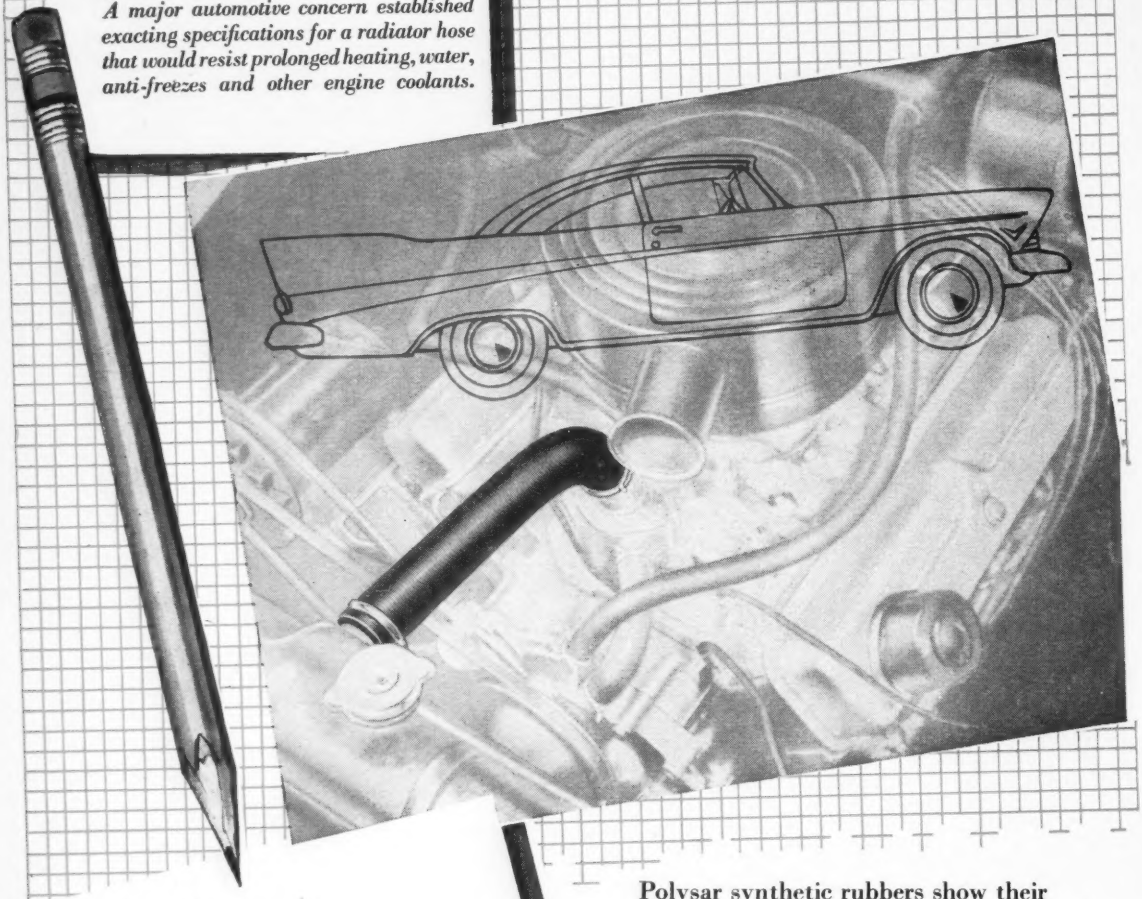
After the war he was associated with Procter and Gamble, in charge of inspection for the construction of five plants. Then, he was department head of inspection for the compressor plant of the Norge Division, Borg-Warner Corp. in Chattanooga.

At Norge he became acquainted with the Fusite glass-to-metal hermetic terminals. His interest in these led him to join the firm (a pioneer in the field) in 1950.

Graduating in 1943 with a degree in physical metallurgy from the University of California, **Robert C. Singleton,** who wrote the article on Stud Welding, worked two years as a metallurgist for the Joshua Hendy Iron Works, Sunnyvale, California. He then joined the Nelson Specialty Welding Equipment Corporation, San Leandro, California, as a field engineer, servicing and developing stud welding equipment and methods in West Coast shipyards. He became senior metallurgist of the company in 1945 devoting a major portion of his time to the theoretical aspects of stud welding.

Problem

A major automotive concern established exacting specifications for a radiator hose that would resist prolonged heating, water, anti-freezes and other engine coolants.



Solution

Firestone Tire & Rubber Company of Canada Limited used Polysar Butyl to produce a hose which met the specifications in every detail. Polysar Butyl's unique properties made it the ideal choice for the job and gave Firestone's customer a hose with inherent long service life.

Polysar synthetic rubbers show their versatility in many ways. Whether it be improving radiator hose or giving longer life to children's footwear they offer technical advantages in practically every type of industry.

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Reports

News in brief from the world's producers

Metallurgy of Iron and Steel

McMaster University, Department of Extension (in co-operation with Hamilton College) offers an extension certificate in the metallurgy of iron and steel. All classes will take place in the evening during the winter session and must be taken by personal attendance. The certificate is intended for people now employed in the iron and steel industry who could profit from a metallurgical curriculum designed to cover the fundamentals and descriptive work of the iron and steel field.

Environmental testing

The new half-million dollar laboratory for Canadian Westinghouse Company in Hamilton, Ontario, is equipped with two Tenney environmental test chambers. Designed to test airborne electronic equipment, the new laboratory has facilities for testing vibration, impact, sustained acceleration, climatic and altitude.

It has a Tenney stratosphere chamber, one of the most compact and complete ever built. Specifications called for a single unit that could simulate all the varying climatic conditions called for in government specifications.

Correction

In the article on cermets in the October issue of Design Engineering, there was a misprint in the last line of page 67. The word "unable" should, of course, have been "able."

We apologize to the companies concerned and regret any inconvenience that may have been caused—Editor.

Powder metallurgy

Iron particles (ground as fine as a woman's face powder) have been shown to be as fully effective as solid steel in manufacturing a tiny part that triggers the action of Chrysler Corporation's Torque Flite transmission for 1957 cars and trucks.

This clutch lever, that actuates the automatic transmission, is used whether the power comes from a 132 hp 6 cylinder engine or the 375 hp engine of the Imperial.

The compressed metal part was developed by the Corporation's Amplex Division, producers of the widely used self-lubricating Oilite Bearings. Amplex perfected the lever when a steel shortage left no extruded steel bars from which the part was formerly made. An alternative was to make the part from other types of steel, but these would have required complex machining to produce the clutch lever.

The cost and time needed to do such a job would have been almost prohibitive. Engineers turned to the field of powder metallurgy to find a suitable new material for the transmission part.

Steam generating unit

Dominion Bridge Company recently announced the receipt of a contract for a complete steam generating unit which includes the first Canadian use of the "Vibra-Grate" stoker. Though this type of stoker has been in use in Europe for a number of years (and several hundred installations have been made there) the development has been some time reaching North America. In the last few years, it has been gaining favor in the U. S., where a few installations have been made, but the projected boiler plant for the Victoria Street plant of the O'Keefe Brewing Co. Ltd. in Toronto represents the first use in this country. The original design (as used in Europe) is by Steinmuller of Gummersbach, West Germany. In Canada, the stoker is being manufactured by Affiliated Engineering Corporation Limited.

Electricity generator

The 92-ft. "Mayflower" II, a replica of the famous Pilgrim Fathers' ship, recently sailed from Plymouth, England, to Plymouth, Mass.

For the purpose of charging the batteries on board "Mayflower" II, and to help her keep in touch with the rest of the world by radio, and thus ensure a safe and successful voyage across the Atlantic, Crompton-Parkinson (the parent firm of Bepco Canada Ltd.) were called upon to install a modern electricity generator.

New Company

Further recognition of Canada's amazing growth in population and purchasing power is evidenced by an announcement from Ralph F. Peo, Chairman of the Board and President of Houdaille Industries, Inc. of the formation of Strippit Tool & Machine Limited as a new unit in Houdaille's group of diversified industries. He also confirmed the company's purchase of industrial acreage from the Town of Brampton, which will become the site for new factory construction.

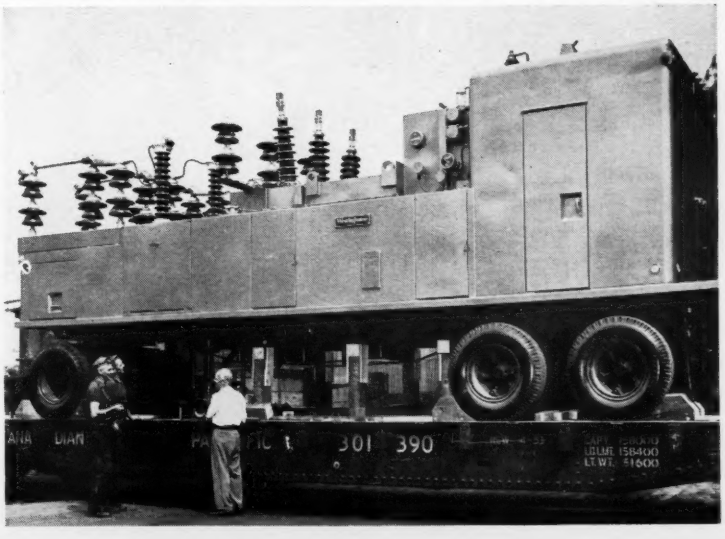
The company will manufacture a broad line of patented, exclusive design punches and dies and allied automatic equipment used principally in sheet-metal fabrication. With this new manufacturing facility in operation, industry will have an adequate Canadian source of supply for this necessary type of tooling, thus obviating the need for importation. The new factory will also be staffed and equipped for the design and manufacture of tools, dies and fixtures and other metal products.

Non-destructive testing

The second international conference on non-destructive testing is to be held in Chicago during the week of November 3 to 8.

The conference, which is being held in conjunction with the second World Metallurgical Congress (sponsored by the ASM), is expected to attract delegates from all over the world.

Canada's first complete substation rolled away to West Kootenay recently.



Air moving equipment

An international program (soon to be announced by the Air Moving and Conditioning Association) will provide a means of identifying name brands of air moving equipment which performs according to the manufacturers' stated ratings.

The program has been developed to protect specifiers and users of centrifugal, axial and propeller fans and power roof ventilators against incorrectly or improperly rated equipment.

Most leading U. S. and Canadian manufacturers of such air moving devices will take part in the program. Each qualifying company will be required to sign a license agreement with AMCA to maintain manufacturing control, so that each unit of the same size and type will have identical performance ratings.

All product testing necessary for qualification under the AMCA program must be conducted in test laboratories inspected and approved by the Association. All published performance ratings must be the results of such tests or calculations permitted by the AMCA Standard Test Code.

Ferroelectrics

Intensive exploration in the field of ferroelectrics has resulted in the discovery of a new ferroelectric material by B. T. Matthias at Bell Laboratories. Known chemically as triglycine sulphate, the material has a rectangular voltage hysteresis loop and other desirable properties which make it very promising for switching circuits and memory devices. Ferroelectrics are, of course, materials which can be switched rapidly from one polarization to another by means of an applied voltage gradient of sufficient magnitude and proper polarity. They will retain a given polarization until switched.

The most popular ferroelectric crystal previously investigated is barium titanate. Triglycine sulphate is superior in that it has a much lower coercive field (220 volts/cm), thus permitting switching with a lower voltage. Its polarization results in a lower output pulse when switched, but the size of the pulse can be increased by increasing the area of the switching electrodes.

Gear production

Sykes Tool Corporation Ltd. of Georgetown, Ontario, and Montreal have recently moved into new premises and expanded their gear production facilities.

With the installation of a Model 3C horizontal generator (manufactured by the British associated company W. E. Sykes Ltd.) they are now able to supply external gears up to 40 in. OD and internal gears with a maximum blank diameter of 40 in. Spur gears from 2½ to 36 DP and helical gears from 3 to 36 DP can be produced.

New plant

Canadian Pollard Bearings Ltd., a subsidiary of Pollard Bearings Ltd. of Ferrybridge, Yorkshire, has finished the first stage in the construction of a multimillion-dollar plant in Oakville, Ontario. They will manufacture automotive, agricultural and industrial bearings.

New office

Union Carbide Canada Limited today announced plans to build a $4,500,000 head office building on Eglinton Avenue East, Toronto. This 11-story building (with a gross floor area of 180,000 sq. ft.) will bring together the management personnel of Union Carbide Canada Limited and its operating Divisions: Bakelite Company, Carbide Chemicals Company, Electro Metallurgical Company, Linde Air Products Company and National Carbon Company.

The structure, the first of its kind in Canada, will be of contemporary metal wall design and will feature glass, metal and granite on the facade. All interior columns will be eliminated. The entire building is to be laid out on a five-foot module. This, together with movable type partitions, will permit complete flexibility in office layout. The completely air-conditioned building is designed for low-maintenance modern occupancy.

Selection of this site on the south side of Eglinton Avenue East between Redpath Avenue and Lillian Street spotlights the excellent facilities of this area: the subway, convenience to residential areas and the new Eglinton Avenue extension.

Land navigation

It is no longer necessary for desert wastes or arctic bleakness to be "trackless" to military or civilian vehicles. Thanks to a new "black box," they can be navigated safely, efficiently and with confidence (according to an article appearing in a recent issue of Army magazine).

According to the article, great strides have been made in developing vehicles for traveling over difficult terrain conditions — snow, sand, marshes and the like. But an additional problem has long needed solution: navigation in difficult or unmapped areas. Until now, no satisfactory means has existed for locating precise position.

Arctic, sub-arctic and desert areas are examples of generally unmapped terrain, where the lack of landmarks presents extreme navigational difficulties for land vehicles. And, vehicular movements performed at night, even over mapped terrain, present navigational problems almost as difficult.

The new "black box" enables the operator of a tank or other vehicle to know his exact position, how to reach a designated position and how to return to any given base. This computer draws heavily upon the design and development work Ford Instrument has done on air navigation equipment, giving the "black box" a background of reliability.

Next month in Design Engineering

DECEMBER

Frontier 40-E Alloy:

Details of an aluminum alloy that was specially developed to produce high strength aluminum castings without the usual heat treatment.

Thickness measurement of thin films:

Methods used for measuring the thickness of thin coating films, with particular reference to the eddy current method.

Comparator chart:

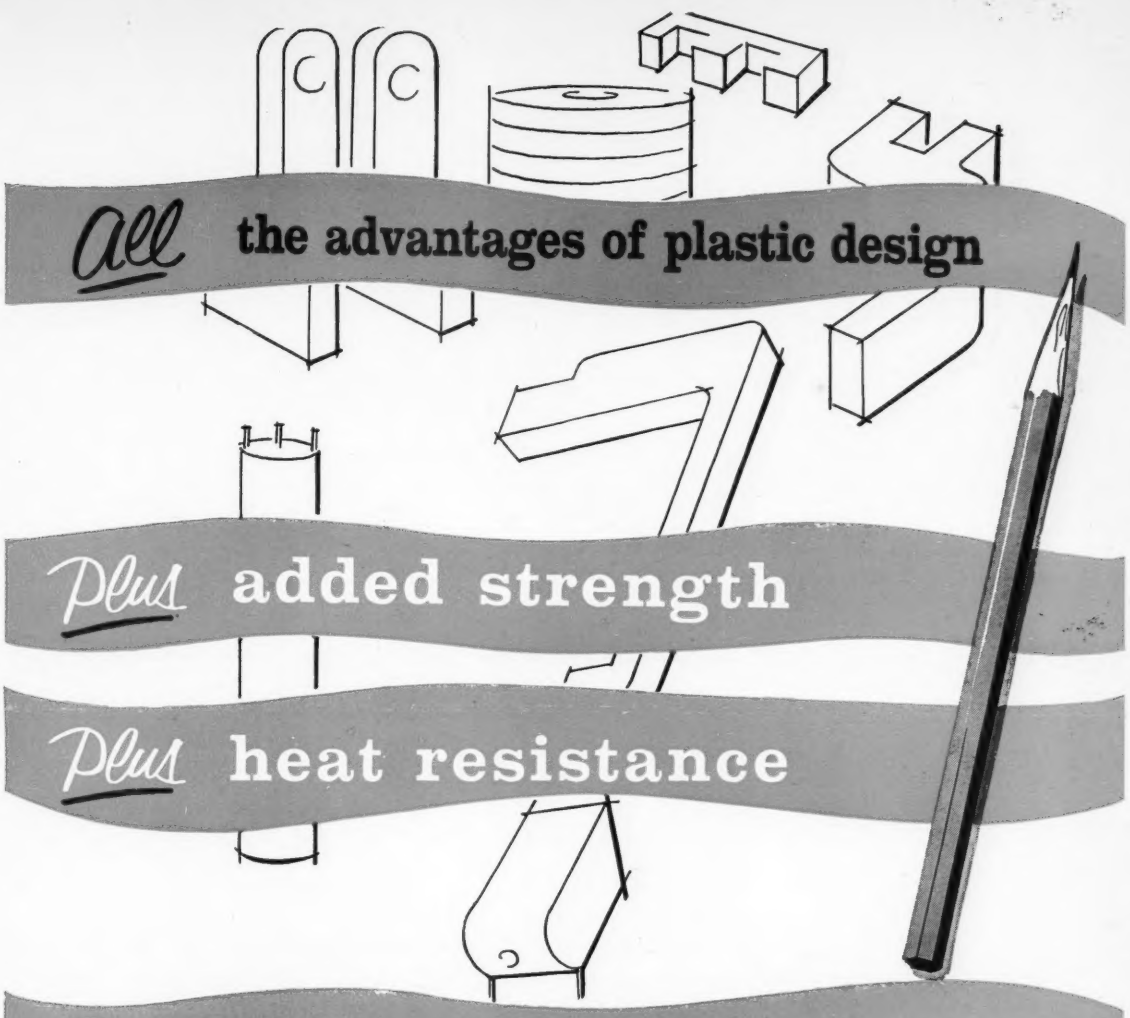
This article includes a basic materials chart to aid in solving design problems.

Dry compressed air:

The characteristics of compressed air and drying techniques that can be used.

Thermocouples:

Information for the design engineer on the different types of thermocouple and their application.



All the advantages of plastic design

Plus added strength

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*T.M. Reg'd.

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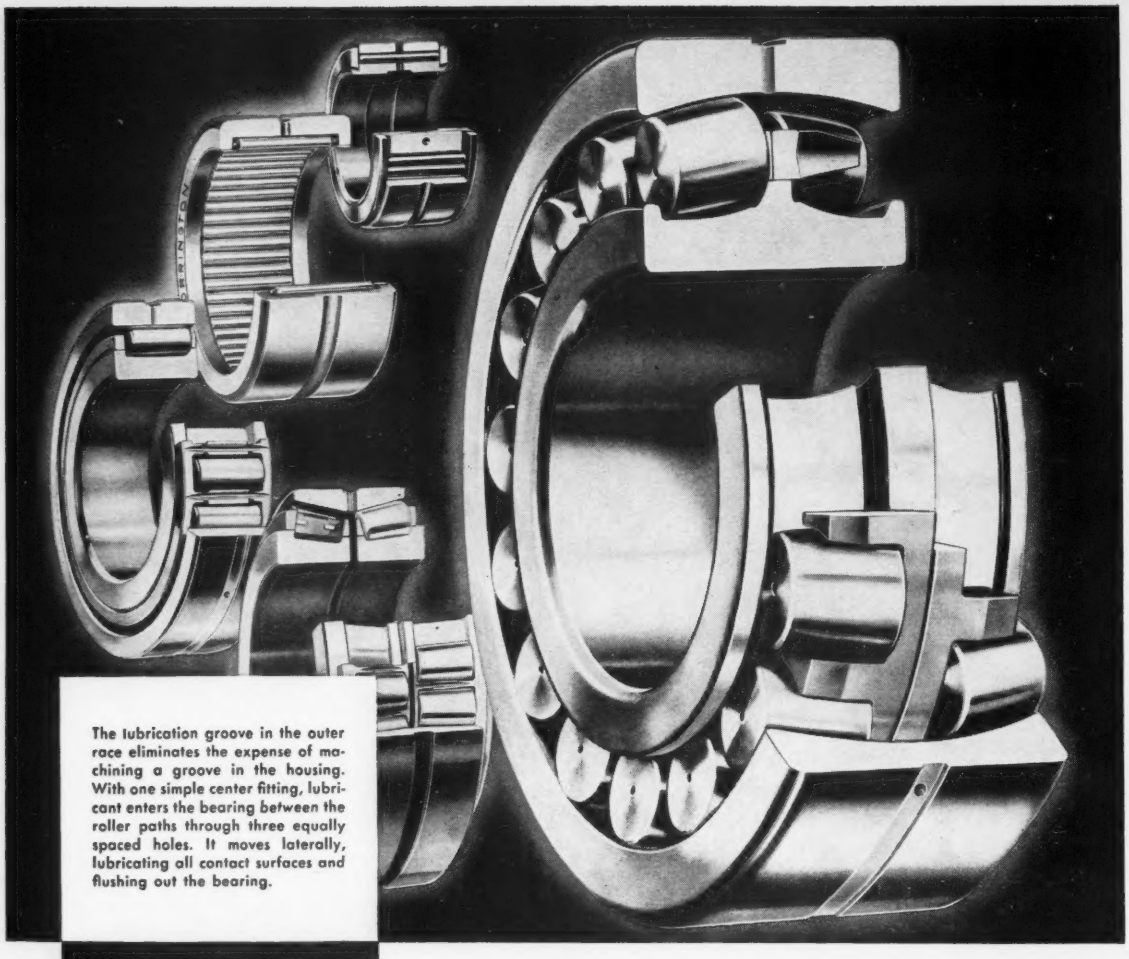
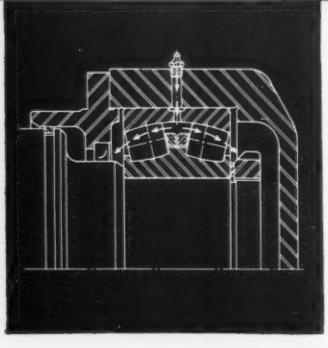


The lubrication groove in the outer race eliminates the expense of machining a groove in the housing. With one simple center fitting, lubricant enters the bearing between the roller paths through three equally spaced holes. It moves laterally, lubricating all contact surfaces and flushing out the bearing.



A time-proved lubricating method now available on Torrington Spherical Roller Bearings

The circumferential groove in the outer race has met the test of experience in many Torrington Bearings, including Heavy Duty Needle Bearings, Aircraft Type Needle Bearings, Tapered and Radial Roller Bearings. Now the circumferential lubrication groove is available in Torrington Spherical Roller Bearings.

This design feature makes it possible to introduce lubricant *between* the roller paths without the expense of machining a groove in the housing. This groove is proportioned to provide generous lubricant flow capacity. Lubricant moves through the roller paths, flushing used lubricant and contaminants away from bearing contact surfaces.

Torrington Spherical Roller Bearings in many sizes may be ordered with this groove as desired at no additional cost. For further information, see your Torrington representative or write: **The Torrington Company, Limited, 925 Millwood Road, Toronto 17, Ont., Canada.**

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THE AVRO ARROW

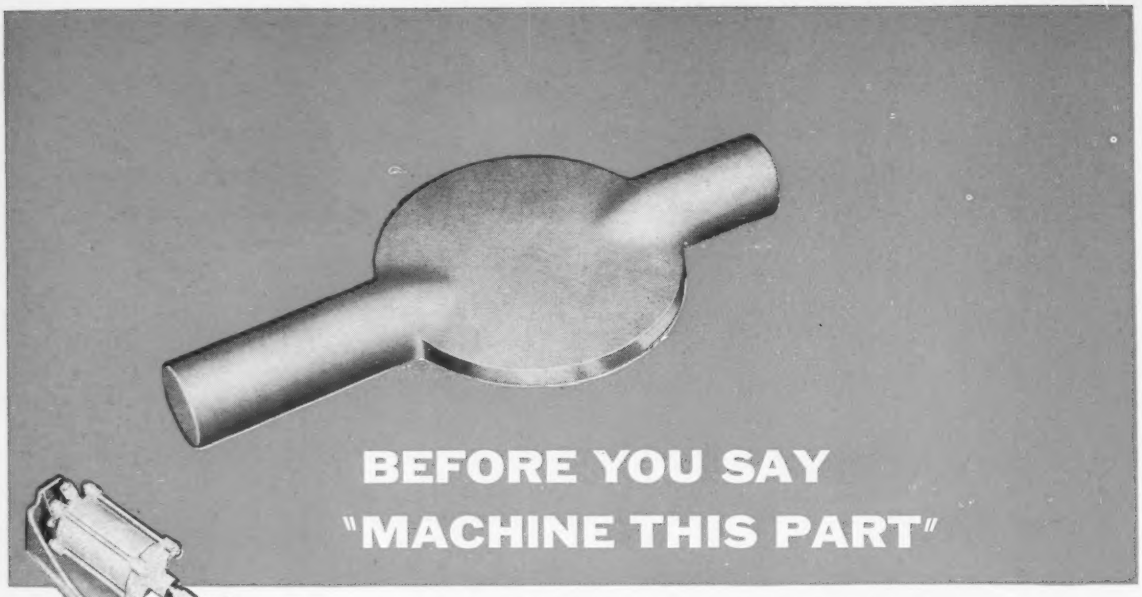
The name selected for the still secret AVRO CF-105 is symbolic of the pointed missile concept of this supersonic interceptor, being developed as the successor to the AVRO CF-100.

AVRO AIRCRAFT

AVRO AIRCRAFT LIMITED

MALTON, CANADA

MEMBER: A.V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP



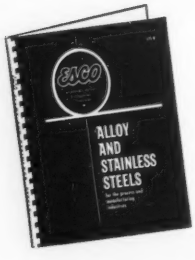
BEFORE YOU SAY "MACHINE THIS PART"

Call an ESCO Casting Engineer

It's often the seemingly simple parts that cause the production "headaches". In this case the "butterfly"—the simple disk and shaft assembly in an exhaust gas actuated power brake. These small parts presented complicated machining and fabricating operations. The elliptical shape of the disk, the compound bevel of the disk edges, the slotting of short length of shafting, welding the shafting in perfect center and alignment on the disk and finally the turning of the shaft ends or bearings. All this fabrication had to be done in a heat-resistant steel to eliminate warpage of the disk, because the blow-by of exhaust gases would result in decreased operational efficiency of the power brake unit.

Oftentimes the answer to such a problem can be as simple as this one was.

. . . "Shellcast this part". And the result . . . a one piece casting combining the elliptical beveled disk with an integral shaft. Cast so smooth and to such close tolerances that the only machining operation to be performed was the bearing ends of the shaft. Heat-resistant *ESCO* Alloy 43H, (A297-55 Grade HH) also eliminated the warpage problem at the same time.



Whether you make butterfly valves, or any one of a million or more complicated components of either low or high alloy steels, before you say "machine this part" call an *ESCO* Casting Engineer.

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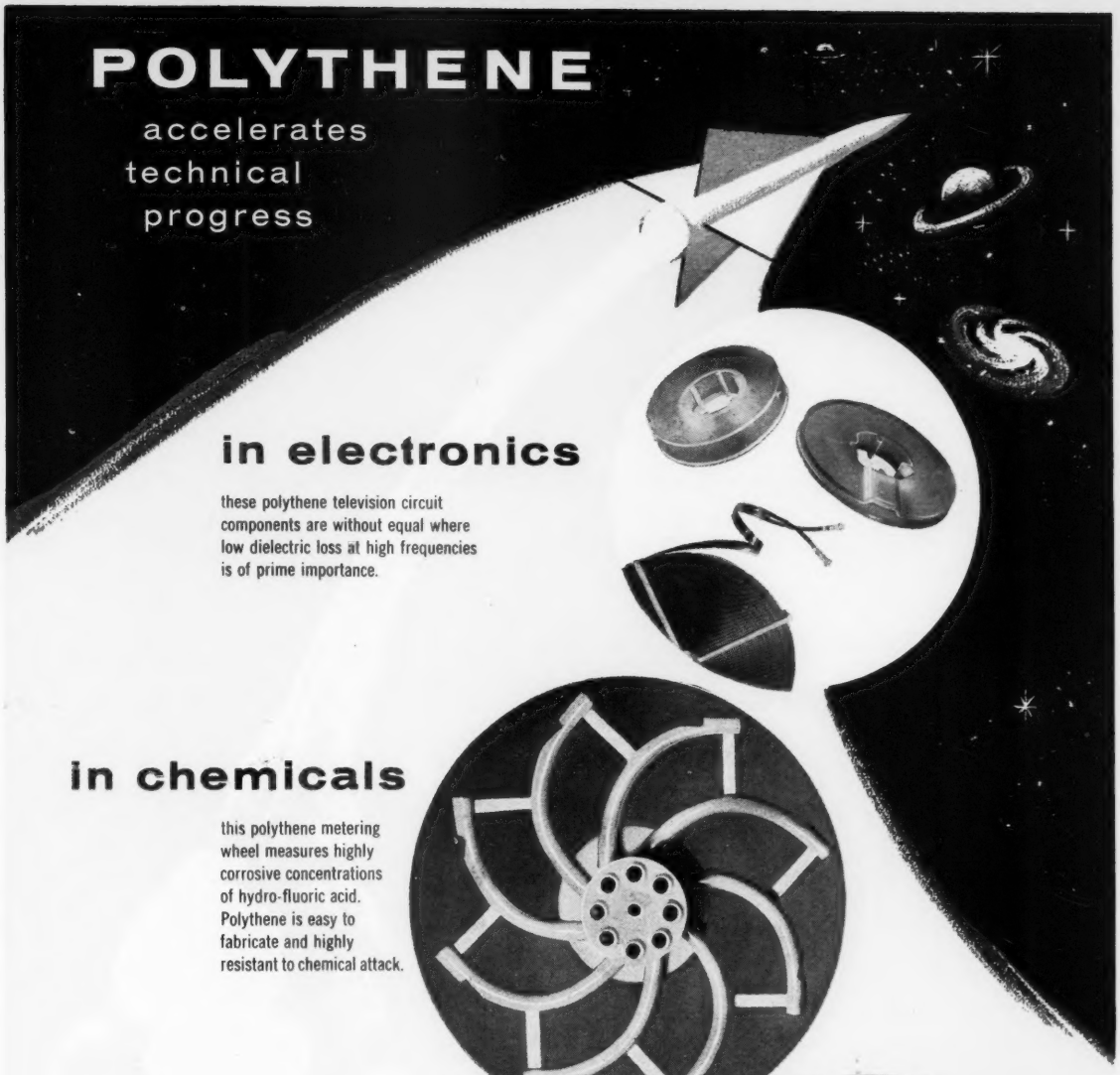

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these polythene television circuit components are without equal where low dielectric loss at high frequencies is of prime importance.

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New trends and developments in designing electrical products...

• How complex permanent-magnet assemblies are built to desired field patterns from simple magnet shapes

G-E permanent magnets provide unlimited design flexibility

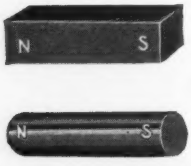
The fundamental problem in designing with permanent magnets is how to provide a specific magnetic flux in a desired field pattern.

In solving this problem, a designer can choose from seven General Electric Alnico grades, hundreds of styles, weights from a fraction of an ounce to a hundred pounds. He can use magnets with two poles – or many poles; with poles at the ends – or anywhere along the magnetic axis.

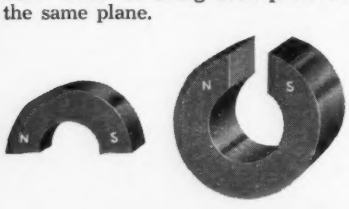
This all gives tremendous flexibility to the design of permanent magnets and magnet assemblies. But precisely because there are so many sizes, shapes, strengths, and other factors to be considered, this flexibility can make the designer's job far more complicated.

So, to help give a clearer understanding of what can and cannot be done with G-E Alnico permanent magnets, we have prepared this description of basic magnet shapes.

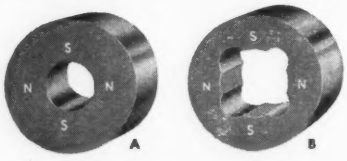
The simplest forms of a permanent magnet are the bar and rod. They are normally salient (i.e., the poles occur at the ends), and may be of any cross-sectional area.



U- and C-shaped magnets are simply bars "bent" to bring both poles to the same plane.



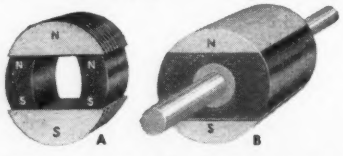
Carry the bending process to its ultimate conclusion and you have the cylinder (see top of next column) with or without the hole. A cylindrical magnet can be magnetized with as many poles as desired on the outside diameter (A), or the inside diameter (B). Not only can the size and shape of the hole be varied, but the magnet can be made salient (B), or nonsalient (A).



All other forms are merely variations on the original themes, even to such nonstandard shapes as these:

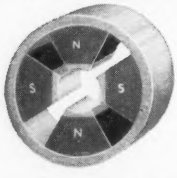
Use of pole pieces adds to design possibilities

One basic use of pole pieces is to provide a return path for the magnetic flux. Pole pieces may be solid (B), or laminated, like this generator magnet (A).



Designers can easily assemble pole pieces and properly shaped permanent magnets to obtain their required field patterns.

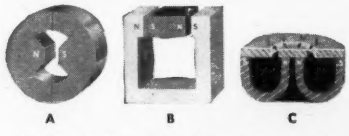
One version is this stator assembly, designed to provide inner poles. The



design can be altered in various ways, depending on mechanical, space, magnetic, or physical properties required.

For example, here is another 4-pole magnet using soft steel. It is also possible to construct an assembly with as many poles as required—by using a number of bar magnets or by using one 2-pole magnet.

Perhaps the most important consideration in the design of magnetic assemblies is the amount of flux across the air gap. These air gaps may be single (A), double (B), or annular (C).



Soft-steel pole pieces are often used to complete the magnetic circuit, allowing maximum flux density though the air gap, with a minimum amount of permanent-magnet material. However, there are a considerable number of variations possible, either with or without pole pieces.

Our G-E magnet engineers have broad knowledge and experience in the design and construction of permanent magnets, pole pieces, and air gaps. They will be more than happy to share their knowledge with you. There is no obligation, and all information is held in strictest confidence. A letter to us will get them to work on your problem immediately.

For engineering assistance or technical literature giving complete data on design and properties of permanent magnets, write to: Permanent Magnet Section, Canadian General Electric Co. Ltd., 940 Lansdowne Ave., Toronto 4, Ontario.

Permanent Magnet Section

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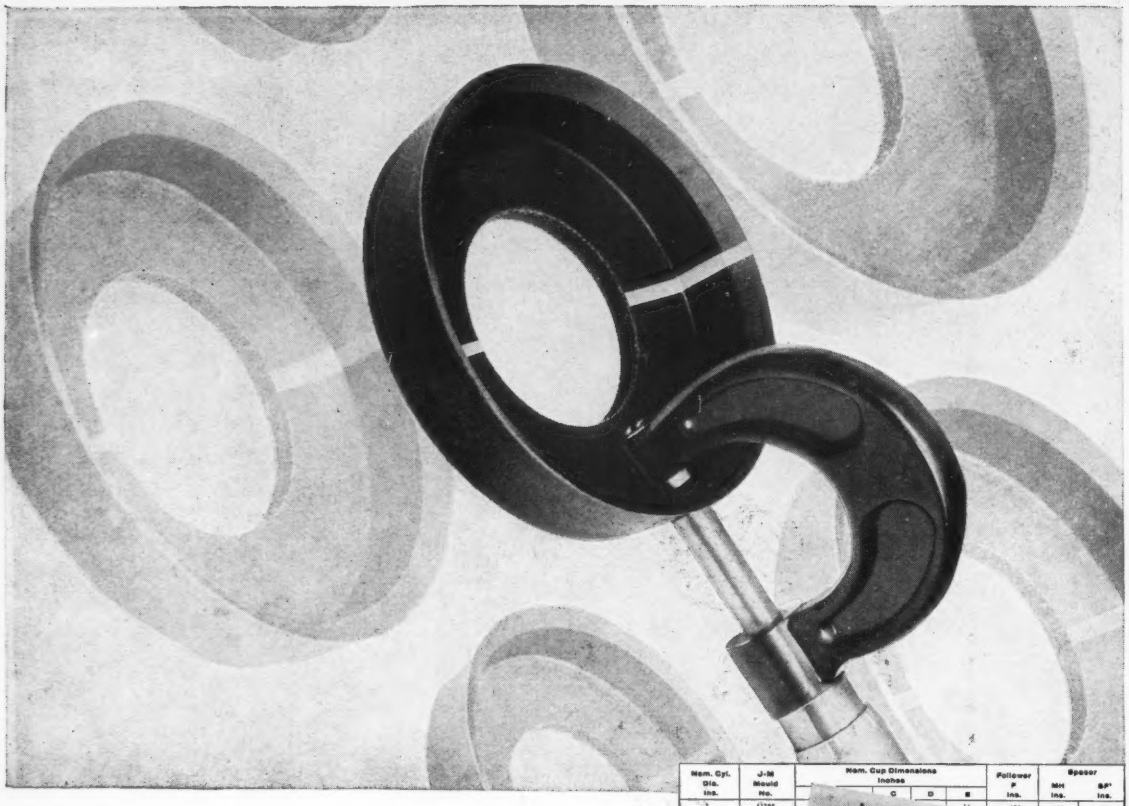

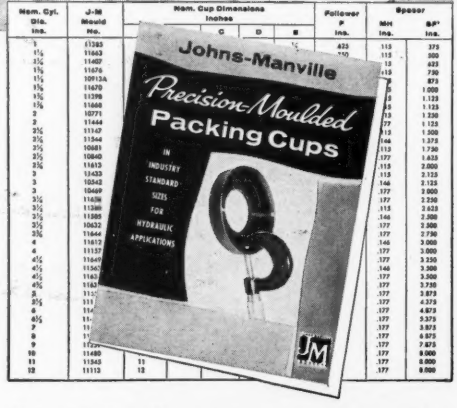

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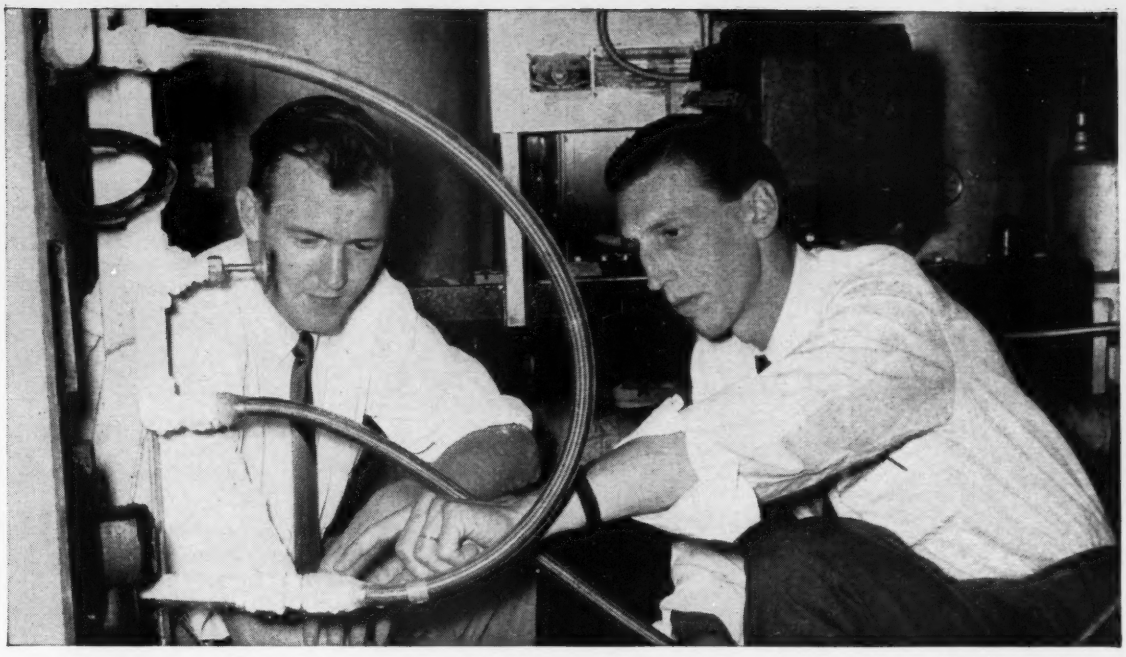

Severe Problems of Handling Chemicals Solved with Aeroquip 2802 Hose Lines of TEFLON*

You Reduce Maintenance Costs Because Aeroquip "*super gem*" Fittings are Reusable

Example: Methylene chloride is essential in the processing and packaging of insecticides and other compounds by Connecticut Chemicals (Canada) Ltd., Toronto, producer of aerosol products . . . but it's notoriously tough on all kinds of hose lines, except one—

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In more than a year of service, Aeroquip Hose Lines of Teflon have performed flawlessly for Connecticut Chemicals. They are excellent for use with methylene chloride as well as other chemicals and fluids for these reasons:

Chemical stability prevents deterioration and flaking of hose. *Chemical inertness* prevents contamination when changing from one product to another. *Lubricity* assures good drainage and flushing of lines. *Wide temperature range* accommodates —100°F to +500°F. *Flexibility* of hose allows various connections for quick conversions.

Aeroquip's corrosion-resistant, stainless steel "*super gem*" Fittings are the only detachable, reusable fittings for hose lines of Teflon. By reusing them to make replacement lines, a substantial portion of total hose line cost can be saved. Complete information is available. Fill in and mail the coupon below for the engineering bulletin you want.

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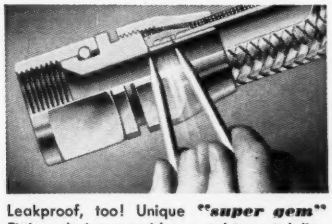

Leakproof, too! Unique "*super gem*" Fitting design provides metal-to-metal line seal (left) and lip seal (right) for perfect sealing at all pressures up to 1500 psi.

*DuPont trade name for its Tetrafluoroethylene resin.

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- ☐ Industrial Engineering Bulletin IEB-26A.
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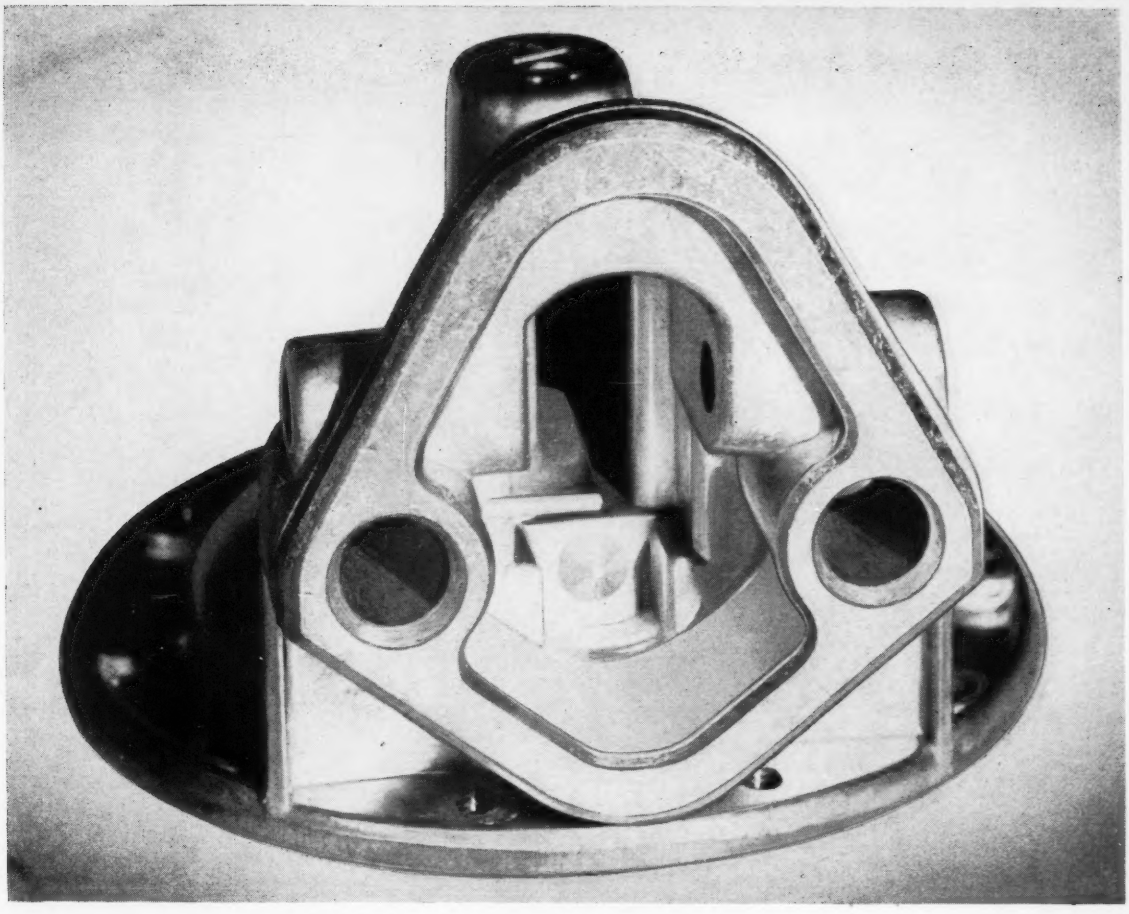

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The photo shows part of an Automobile Fuel Pump Casing

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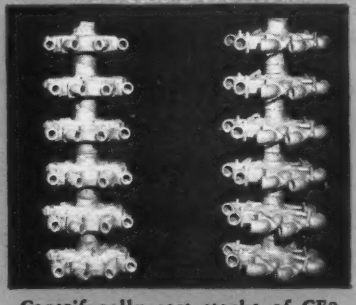
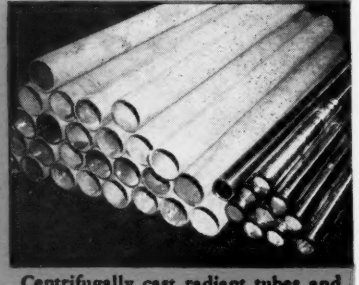


Centrifugally cast stacks of CF8 fittings (as cast condition).

Centrifugally cast HU retorts for magnesium production.



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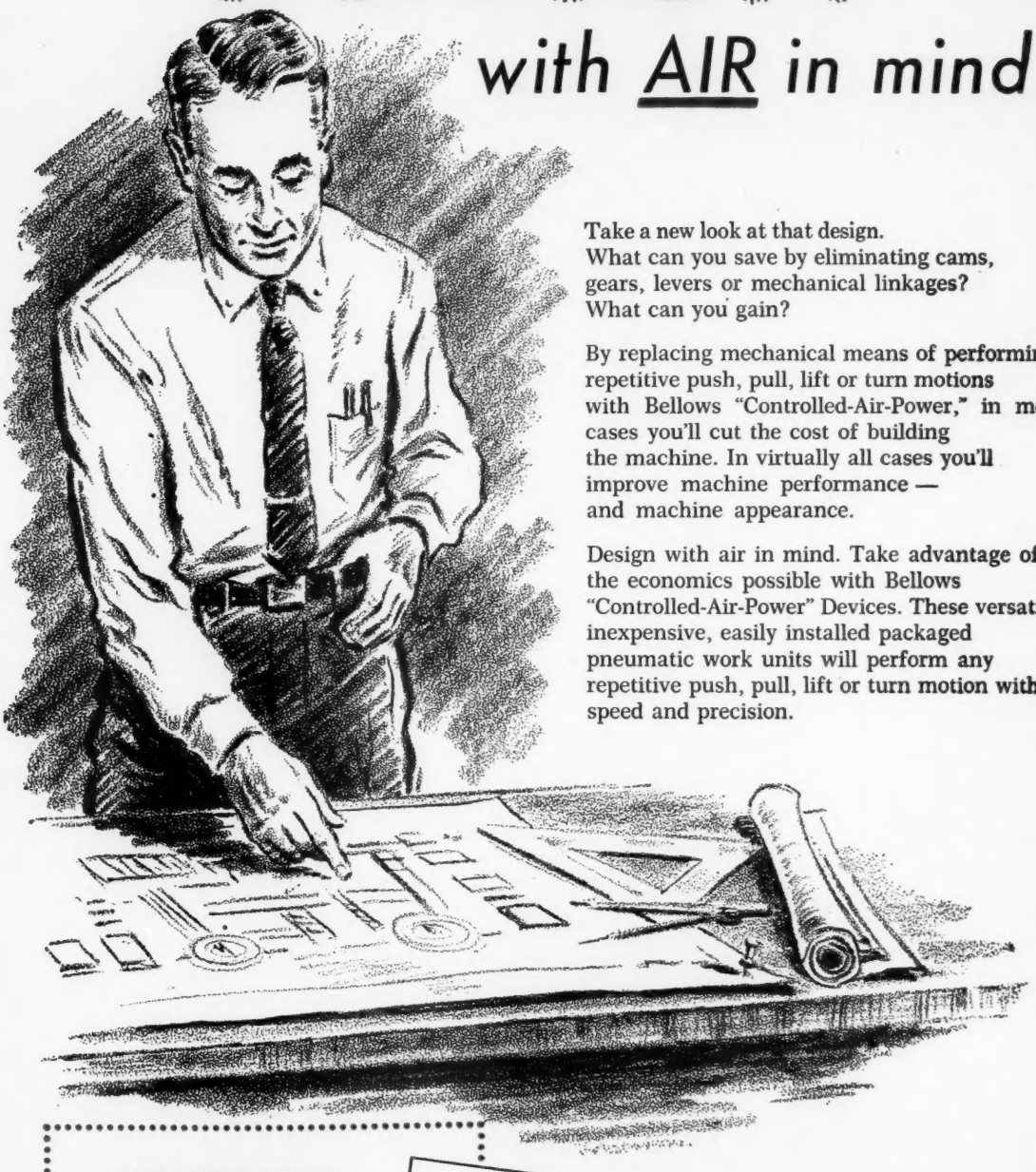

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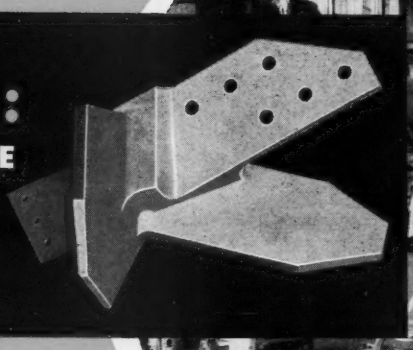

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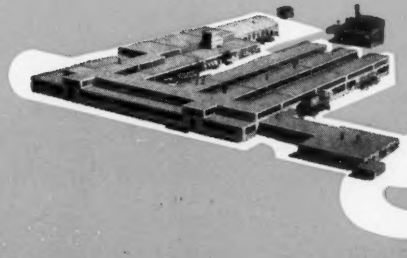

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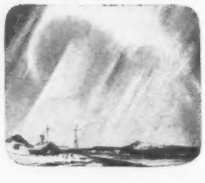

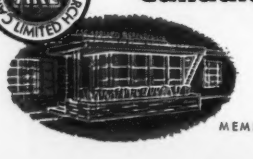

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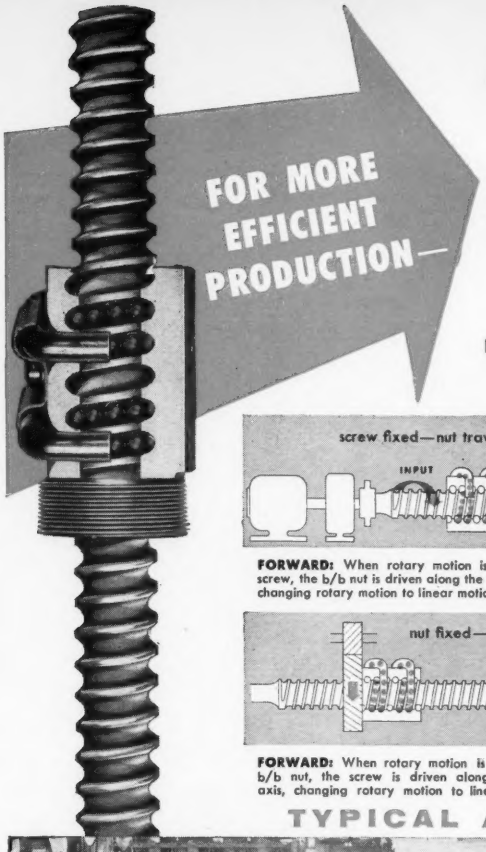

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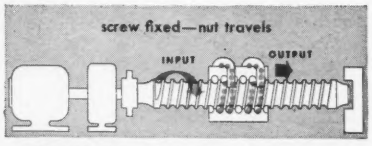
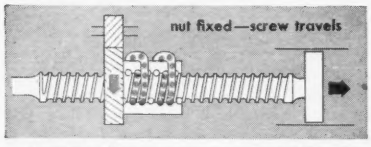
6 decisive advantages reduce manufacturing problems and costs:



FORWARD: When rotary motion is applied to the screw, the b/b nut is driven along the axis of the screw, changing rotary motion to linear motion.



FORWARD: When rotary motion is applied to the b/b nut, the screw is driven along its longitudinal axis, changing rotary motion to linear motion.

1 **POWER SAVINGS.** Operating with over 90% efficiency, Saginaw b/b Screws permit much smaller motors with far less drain on electrical systems, and also simplify circuitry.

2 **SPACE SAVINGS.** Saginaw b/b Screws themselves are compact. They permit smaller motors and gear boxes and eliminate auxiliary equipment required by hydraulics.

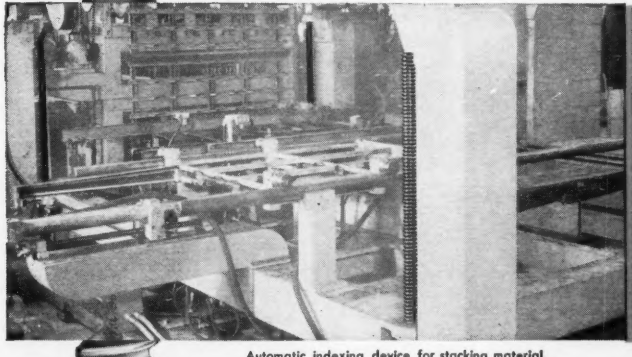
3 **DEPENDABLE PERFORMANCE.** Saginaw b/b Screws are far more reliable than hydraulics or pneumatics. Gothic-arch grooves, yoke deflectors and multiple circuits provide added assurance.

4 **PRECISE POSITIONING.** Saginaw b/b Screws will position components far more precisely than hydraulics or pneumatics; tolerances on position are held within .0006 in./ft. of travel.

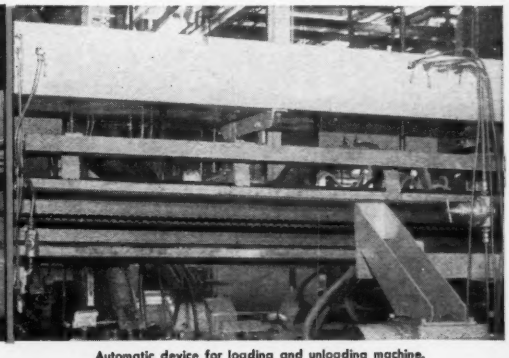
5 **TEMPERATURE TOLERANCE.** Normal operating temperature for Saginaw b/b Screws is from −75°F. to +275°F. But in selected materials, they will function efficiently at temperatures as high as +900°F.

6 **LUBRICATION.** If lubrication fails the Saginaw b/b Screw will still function with remarkable efficiency. Units have been built and qualified for operation without lubrication.

TYPICAL AUTOMATION APPLICATIONS



Automatic indexing device for stacking material. Saginaw b/b Screw used to raise and lower table.



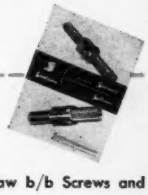
Automatic device for loading and unloading machine. Saginaw b/b Screw used to save power and space.

If you would like further details on the use of Saginaw b/b Screws to increase the efficiency of plant operations, or specific application recommendations for your individual processes, experienced Saginaw engineers are at your service without obligation. Just write or phone us your requirements, or fill in and mail the handy coupon below.

Saginaw ball bearing Screw

SEND TODAY FOR FREE 36-PAGE ENGINEERING DATA BOOK . . .

or see our section in Sweet's Product Design File



Saginaw Steering Gear Division
General Motors Corporation
b/b Screw and Spline Operation
Dept. 1W, Saginaw, Michigan

Please send new engineering data book on Saginaw b/b Screws and Splines to:

NAME_____

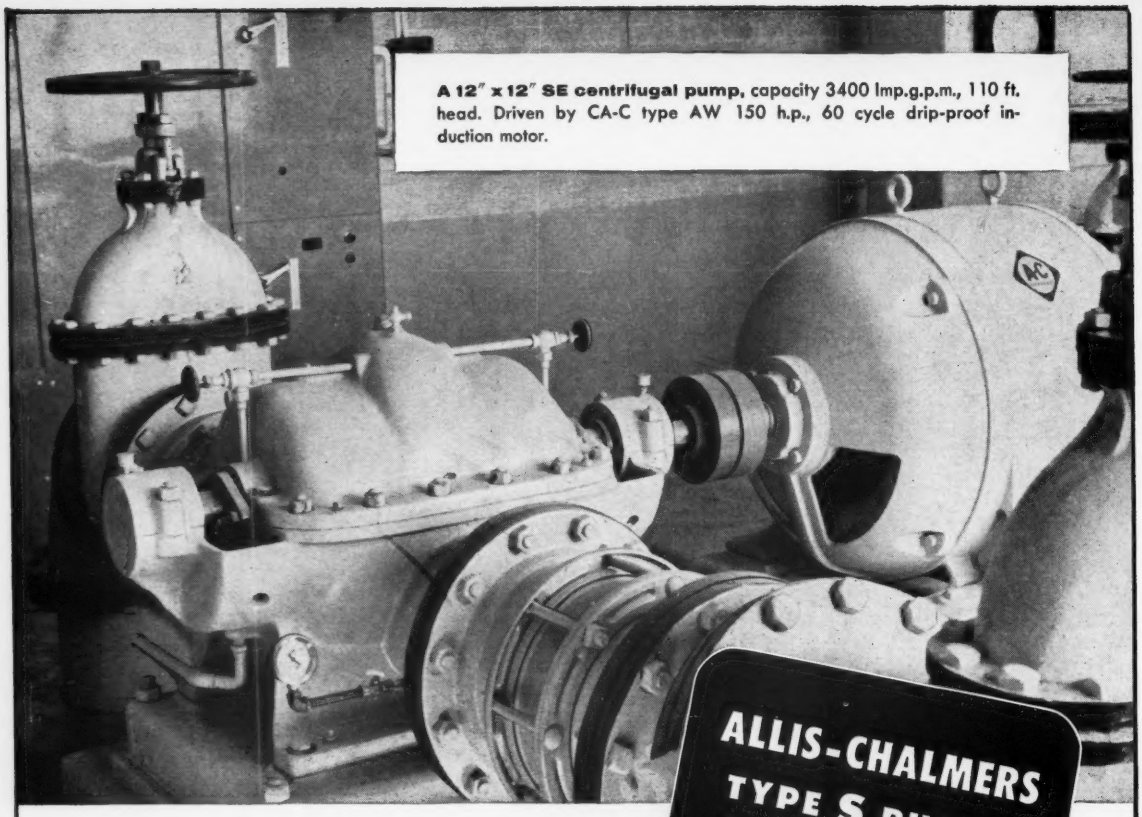
COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE____ _____

SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS • SAGINAW, MICHIGAN

WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES



A 12″ x 12″ SE centrifugal pump, capacity 3400 Imp.g.p.m., 110 ft. head. Driven by CA-C type AW 150 h.p., 60 cycle drip-proof induction motor.

ALLIS-CHALMERS TYPE S PUMPS AND MOTORS

ONE OF 10 CA-C PUMPS CHOSEN FOR THE

CITY OF LETHBRIDGE

by men who look beyond the price tag for built-in dependability

Another municipal installation of CA-C's type 'S' pumps and motors was recently completed at the reservoir and powerhouse in Lethbridge, Alberta. Here are some of the reasons for the wide acceptance of these single stage, double suction pumps by municipal authorities and industrial users across the country:—

- **High Efficiency** Each pump is custom-built for its specific application, the exact dimensions and type of impeller being selected on the basis of Allis-Chalmers' many years of experience in pump installations.
- **Less Power Consumption** Because the operating characteristics of the pump are so precisely tailored for the job it has to do, wastage of power is considerably reduced. When driven by an Allis-Chalmers "matched" motor, the Type S pump offers the lowest operating costs attainable today.
- **Easy Maintenance** Rotating element can be removed without disturbing piping or motor; easy access to packing; low cost replaceable parts at all points of wear.
- **Rugged Design** Long heavy casing support dampens vibration and reduces distortion. Ample strength is assured by generous use of metal at strategic points.
- **"CA-C Package Deal"** The pump can be supplied by CA-C complete with motor and control of co-ordinated design and manufacture. This means one responsibility, one guarantee of satisfaction.

★

If your need is for dependable, low-cost operation, consider the CA-C type 'S' pump. Available in a wide range of sizes with nozzles from 1" to 48".

For further information, contact your nearest CA-C office, or write direct to Canadian Allis-Chalmers Limited, P.O. Box 37, Montreal, P.Q.

MADE IN CANADA

CANADIAN ALLIS-CHALMERS

56-P-3

ATLAS STEELS

ATLAS STEEL NEWS

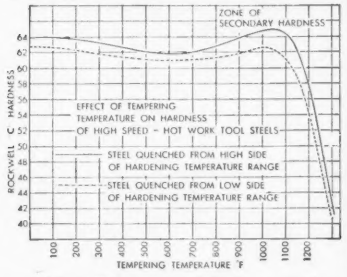
TOOL STEELS • HIGH SPEED STEELS • MINING DRILL STEELS • SPECIAL PURPOSE STEELS • STAINLESS STEELS

TECHNICAL TIPS
FROM YOUR ATLAS TROUBLE SHOOTER

HEAT TREATING HOT WORK TOOL STEELS

One of the basic rules regarding the hardening of parts used for hot work applications is that they be tempered at a temperature which is at least equivalent to, or preferably 50 to 100 degrees F in excess of, the maximum surface heat attained by the tool in service. Double drawing is a good practise to observe in most instances. Steel should be held for at least 2 hours per inch of maximum section.

All hot work tool steels can be air quenched to develop full hardness. This is conducive to optimum toughness, resistance to heat checking, minimum distortion and tendency for


ZONE OF SECONDARY HARDNESS
EFFECT OF TEMPERING TEMPERATURE ON HARDNESS OF HIGH SPEED - HOT WORK TOOL STEELS
STEEL QUENCHED FROM HIGH SIDE OF HARDENING TEMPERATURE RANGE
STEEL QUENCHED FROM LOW SIDE OF HARDENING TEMPERATURE RANGE
ROCKWELL C HARDNESS
TEMPERING TEMPERATURE °F

cracking. However, with those grades hardened from over 2000 degrees F, the extra scale formed by air cooling is sometimes objectionable and it is advisable to oil quench. In the majority of cases interrupt oil quench or salt quench is recommended.

If for some particular application, maximum resistance to red wear is required, it is common practice to use the top of the hardening temperature range. On the other hand, optimum toughness and resistance to fire checking is obtained by quenching from the low side of this range.

ATLAS STEELS LIMITED
WELLAND, ONTARIO
BRANCHES: TORONTO, MONTREAL, HAMILTON, WINDSOR, WINNIPEG, VANCOUVER.
REPRESENTATIVES: LONDON, ST. CATHARINES AND SUDBURY.
AGENTS THROUGHOUT THE WORLD.

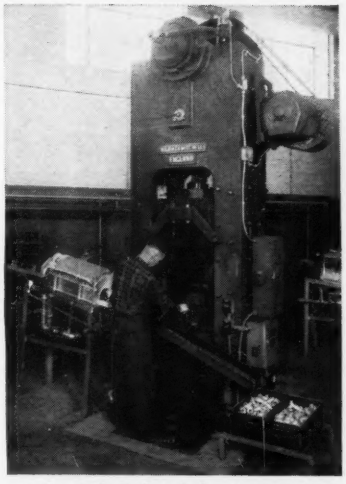
50,000 PIECES WITHOUT DIE REPAIR!

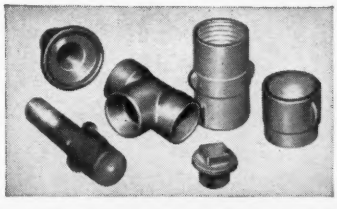
Seneca Hot Die Steel Gives Outstanding Results

Atlas Seneca hot die steel is playing a big part in one of Canada's most advanced cored forging operations. Canada Metal Company Limited has adopted the principle of heating a slug of extruded brass or copper to about 900°F and forging it with one stroke into a finished, or semi-finished part. Obviously this system reduces machining, material and buffing, while providing stronger parts with denser structure . . . at less cost.

Canada Metal's production men are more than pleased with the performance of Atlas Seneca hot die steel in this operation. They report runs of up to *50,000 parts before clean-up or repair is necessary!*

Atlas Seneca is a tungsten type hot work steel designed for temperatures between 800° and 1200°F. Good wear resistance is an outstanding characteristic.





A few examples from the wide variety of brass pressings and cored forgings currently being manufactured by Canada Metal's Scarborough Plant.

Atlas Metallurgists Create New Steel To Meet Exacting Customer Specifications

Atlas Metallurgical Division recently solved a ticklish steel problem for Dowty Equipment of Canada Limited. This customer called for a special steel with high ultimate tensile strength, clean aircraft quality, excellent transverse physical strength and high tensile strength after special heat treating. Quite an order! Atlas solved the problem with a modified version of Atlas Ultimo-4 High Tensile Machinery Steel. Tests made by Dowty revealed such a consistency of the high mechanical properties needed, that the Atlas shipment was immediately accepted. This tailor-made order is just one example of Atlas versatility.

Shown are controlled atmosphere furnaces at Ipsenlab of Canada Limited, where parts were specially heat treated to high tensile strength.

FREE BOOKLET FOR TOOL BIT USERS

A handy pocket-size booklet on the selection, care and use of tool bits is now available from your Atlas Sales Representative, or direct from Advertising Department, Atlas Steels Limited, Welland, Ont.

Newcomer on the Canadian scene

TYRIL

widens the range of thermoplastics performance

We are proud to introduce Tyril* as the first member of the new family of Dow styrene acrylonitrile copolymers. Tyril is entirely different from any of the familiar Dow thermoplastic moulding materials—its performance will open new horizons in plastics.

The faster cycling and better mouldability of Tyril results in marked economies of production. Tyril has a remarkable balance of physical properties, it is rigid, yields high critical elongation and tensile strength. Tyril provides an improved resistance to heat and to a wide variety of chemicals, organic solvents and food stains.

Tyril lends itself to many applications including, quality tumblers, dinnerware and industrial components requiring toughness and durability.

Tyril is available in natural as well as a wide range of transparent and opaque colours. It has a ready affinity for decorative colours and finishes which should stimulate greater sales.

Capitalize on Tyril! Put the leadership of Dow technical service to work on your production or design problems. For more details, write DOW CHEMICAL OF CANADA, LIMITED, 600 University Avenue, Toronto 2.

PERFORMANCE-PROVED FAMILY OF DOW PLASTICS

*ETHOCEL		EXCEPTIONAL TOUGHNESS	STYRON	777	MEDIUM IMPACT
*STYRON	666	GENERAL PURPOSE		440	HEAT RESISTANT — HIGH IMPACT
	688	EASY FLOW		480	EXTRA HIGH IMPACT
	689	FAST FLOWING FORMULATION		700	HIGHEST HEAT RESISTANCE
	475	HIGH IMPACT	TYRIL		GOOD IMPACT WITH CHEMICAL RESISTANCE

*TRADE MARK

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What is a "Good" Casting?

"Good" is the measure of performance. A good casting measures up—in performance—to all the requirements of its buyer and its end user.

If, during its life, it must withstand repeated thermal shocks, then it must be heat resistant; if it is going to be subjected to constant friction, then it must be wear resistant; if it comes into contact with salts or acids, then it must be corrosion resistant.

"Very true," you say, "and also very obvious. It is one thing to make fine castings to fit the job but can you make the price fit the castings? That's a requirement, too."

We can. That's where our Special Products Plant comes in. It is run by experienced men, controlled by a first class laboratory and equipped with modern foundry equipment —it's an operation that's geared to meet quality *and* price requirements.

Our electric furnace, for example, allows flexibility, versatility and far greater uniformity of composition in the production of all types of iron.

The result: the best possible assurance against being let down half way through the machining operation. Your shop investment is thus protected.

So when *you* need "good" alloy castings, delivered clean and on time, order them from:

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foundries, limited

FOUNDRY & MACHINE DIVISION

HEAD OFFICE: 921 Sun Life Bldg., Montreal

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Literature is available on the following engineering irons and alloy irons produced by our Special Products Plant:

If you would like valuable information on any or all of these irons, tick them off and mail this coupon.

NODULOY ☐ NI-RESIST ☐

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With the machine you design-

When the machine you design goes into practical service it will likely operate in conjunction with auxiliary equipment. The dependability and efficiency of such units will have a definite effect upon your machine — for better or for worse.

Experienced design engineers specify KENNEDY-FALK geared equipment and Falk Steelflex Couplings.

Consult Kennedy engineers wherever and whenever Speed Reducers, Motoreducers, Shaft Mounted Drives and Couplings are applicable. Ask for descriptive bulletins.

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The new MAVITTA 3D Drafting Machine has been enthusiastically welcomed by the Aircraft, Automobile, Engineering Industries and by Architects and Building Contractors. Any Draughtsman can produce 3 dimensional drawings to scale with this exceptionally mobile unit. Clamps to any drawing board or table. Competitive prices. Enquiries invited.

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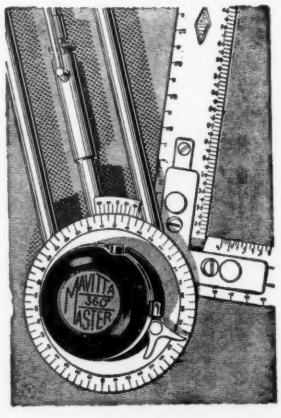
Linkage by steel bands and pulleys — 360 degrees rotation of index head — automatic location of main angles by press button through knob—quick release of head for lining up to drawings—counter balanced for vertical use — modern styling and high quality finish.



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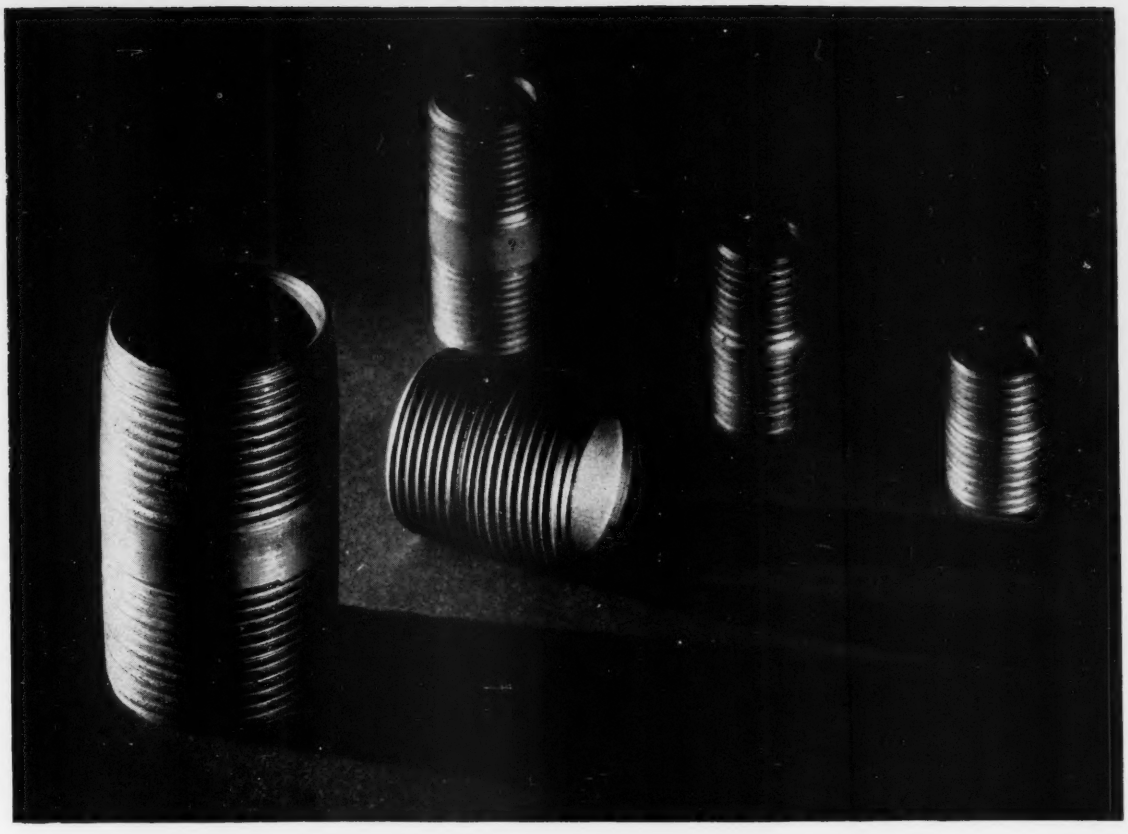

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This is one item required in a complete fluids handling system. It is just as important to you as a valve, tubing or any other part of the system.

To us, who specialize in preventing corrosion in fluids handling, we know that every single item in your system is as important as another.

Failure is prevented when you select the right metal for nipple and nut, pipe and tank, valve and fitting.

What *is* the right metal?

Many factors have to be considered in deciding on stainless steel or aluminum. You can rely on our experience to help you select the metal required.

You can count on our complete stock to supply each item in the metal you require — and promptly!

There is no place for corrosion in your business. Simply take advantage of our service.

We're always ready to help.

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Please send me full technical information on the use of RCI POLYLITE Polyester Resins for:

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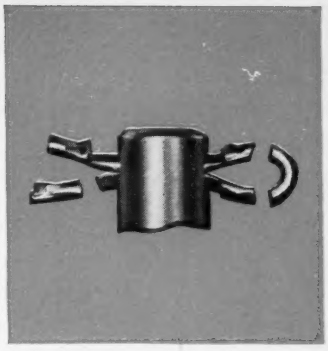
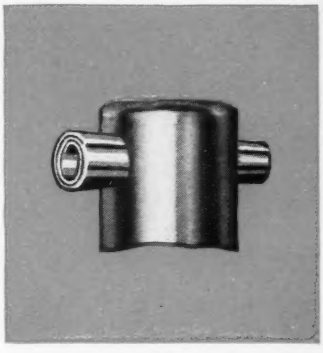
Spirol Pins in Morse Roller Chain resist vibration, absorb shock.



Standard heat-treated cotter pin fails after only 3 hours on fatigue tester. Failure in use means costly downtime.



Spirol Pin shows no sign of fatigue after 50 hours on tester. And it won't shake out or break off like cotter pins.

Another Morse advantage for Canadian users . . .

SPIROL PIN FASTENERS AT NO EXTRA COST . . . A MORSE ROLLER CHAIN EXCLUSIVE

Spirol Pins outlast any other fastener on the market! And they are now featured on Morse Roller Chain at no extra cost.

Spirol Pins resist vibration and shock—won't shake loose or break. These stronger fasteners cut down-time.

Spirol Pins are interchangeable with cotter pins on all Morse Roller Chain now in use. They are easy to install—require no special tools.

Morse Roller Chain has longer service life built in. Specially treated, precision-finished steel parts withstand shock and fatigue . . . reduce operating and maintenance costs.

These are the reasons you can depend upon Morse Roller Chain. So, call your Morse Distributor today for *all* your power transmission needs. His name is listed in the Yellow Pages of your telephone directory. Or write: *Morse Chain of Canada, Ltd., Simcoe, Ontario.*

IN POWER TRANSMISSION
THE TOUGH JOBS COME TO

MORSE*

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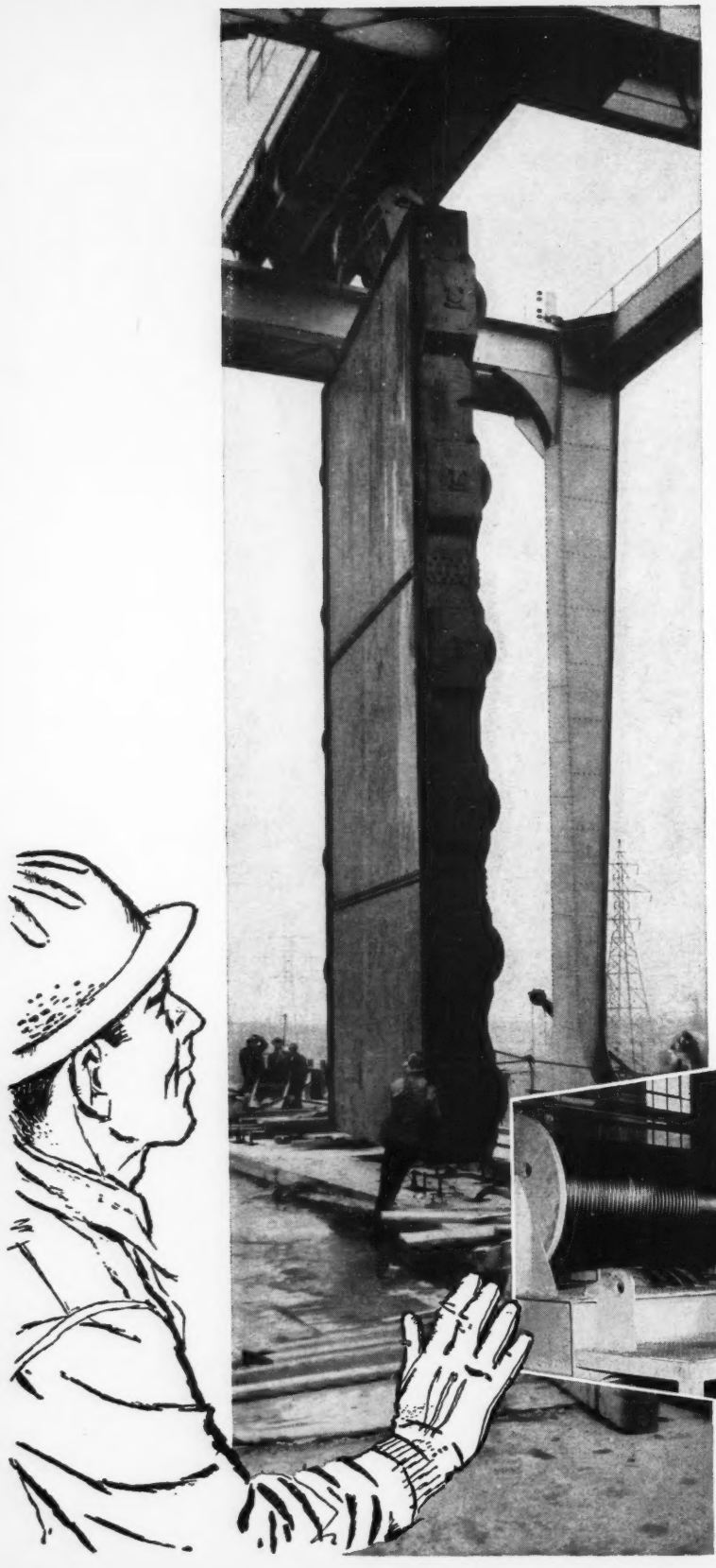

Intake Gates

Illustrated is a completely assembled Intake Gate being lowered into position. This is one of twelve built by Canadian Vickers for the Pumped Storage Scheme part of the Sir Adam Beck No. 2 Development of the Hydro Electric Power Commission of Ontario, at Queenstown.

Shop welded in sections and riveted together in the field, these Gates are designed for a clear opening of 16′-8¾″ wide and 34′-9″ high and subjected to a maximum head on the sill of 77′-6″.

Canadian Vickers designs and builds all types of Water-Way and Water-Power equipment. If it is Vickers-built . . . it's right.

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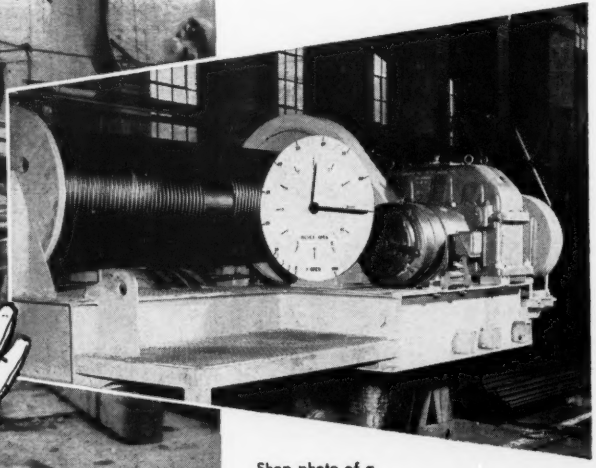
A MEMBER OF THE WORLD-WIDE VICKERS GROUP



Shop photo of a Vickers-built Hoist.

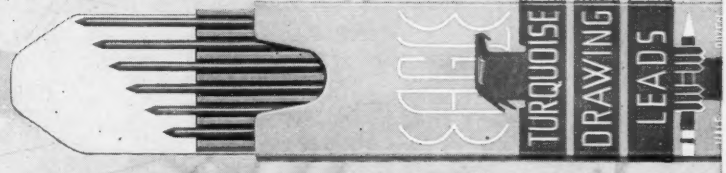
are your **pencils** as sharp as your **perspectives?**

Efficiency reaches the vanishing point when you work with an inferior pencil—but hits a new high when you pick up an Eagle TURQUOISE. This is the pencil that tops 'em all for crisp drawings and reproductions, and these are the reasons: 1. It gives you *uniform grading* (17 scientific formulas guarantee exactly the blackness you want—from every pencil, every time!). 2. It takes a strong *non-crumbling needle point* that stays sharp for line after long line of unchanging width. 3. You get inimitable smoothness—thanks to Eagle's exclusive "Electronic" graphite. TURQUOISE makes your perspectives look sharp—and *you,* too!

WRITE FOR FREE SAMPLE Turquoise wood pencil and naming this magazine—or buy any of these drawing instruments from your favorite dealer.

• **TURQUOISE DRAWING PENCILS:** With 100% ®"Electronic" graphite. 17 grades, 6B through 9H.

WRITE FOR FREE SAMPLE of TURQUOISE wood pencil or drawing lead — or buy any of these drawing instruments from your favorite dealer.



• **TURQUOISE DRAWING LEADS:** Fit any standard holder. Grades 5B through 9H.

• **TURQUOISE LEAD HOLDERS:** Hold any grade of Turquoise lead—so firmly that lead cannot be pressed back.

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CORROSION RESISTANT ALLOYS

MONEL*

TOUGH, RUST AND CORROSION RESISTANT

Strong, tough nickel-copper alloy that resists attack by many organic and inorganic acids, alkalies and salts. Good mechanical properties at temperatures up to 450°C. Widely used in steam plants, chemical engineering and food processing.

"K" MONEL*

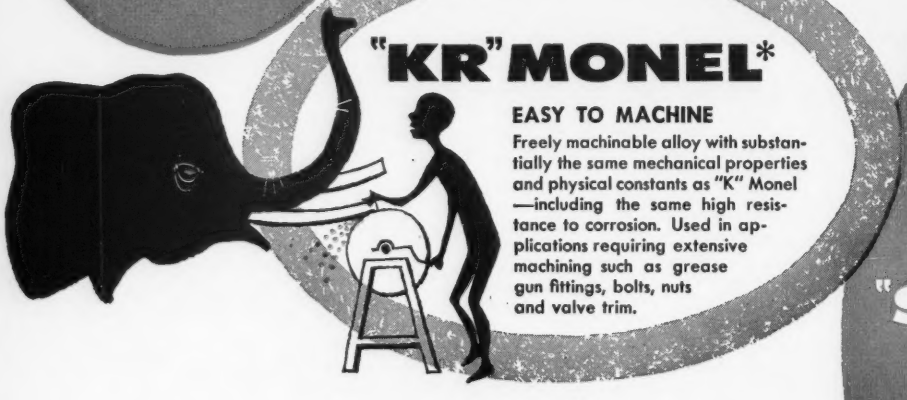
STRONG AND HARD

Combines excellent corrosion resistance with strength and hardness equal to many heat-treated steels. Completely non-magnetic down to −150°F. Used for pump shafts, valve parts and roller chain ... for drill collars, aeronautical instruments, anchor chain links and other non-magnetic applications.

"R" MONEL*

EASY TO MACHINE

Freely machinable alloy with substantially the same mechanical properties and physical constants as Monel—including resistance to corrosion. Used in corrosive applications requiring extensive machining such as automatic screw machine products.



"KR" MONEL*

EASY TO MACHINE

Freely machinable alloy with substantially the same mechanical properties and physical constants as "K" Monel —including the same high resistance to corrosion. Used in applications requiring extensive machining such as grease gun fittings, bolts, nuts and valve trim.

"S" MONEL

RESISTS ABRASION, EROSION AND WEAR

Combines the corrosion resistance of Monel with extra hardness at high temperatures and resistance to galling and seizing. Especially suitable where alignment or tight fit and resistance to corrosion, erosion, wear and abrasion are factors. Used for pistons, valve seats, bearings, pump liners, etc.

The Monel* family of corrosion-resistant alloys provides a unique combination of properties that make them suitable for a wide range of applications in many industries. These alloys are readily workable, responding to most fabricating operations in much the same way as steels of similar yield strength. Most alloys in the Monel family are available in standard forms ... and Inco Customer Service goes with them ... to help you solve metal problems. Write today for complete information.

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INCO
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

25 King Street West, Toronto

THE PROBLEM:

To create and manufacture a practical fastening device to close the seams of the world's largest* Radome . . . to make it simple enough to do the job quickly and easily in sub zero temperature while wearing heavy Arctic-type mitts.

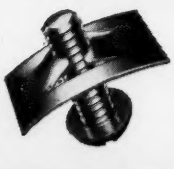
THE SOLUTION:

Creative thinking by Dominion Fasteners' engineers.

Solving tough problems is routine at the Hamilton plant of Dominion Fasteners Ltd. Through a combination of modern facilities and creative personnel, this Canadian company is continually inventing, developing and producing better fastening methods for a wide variety of industries.

Whether you make Radomes or radiators, Dominion Fasteners Ltd. are always ready and able with an efficient, economical solution to your fastening problems.

*The world's largest air-supported Radome was recently completed by Firestone Tire & Rubber Co. of Canada Ltd. Constructed for the USAF by the Electronics Division of Westinghouse under a contract from ARDC's Rome Air Development Center, the Radome measures 61 feet in diameter and is designed to protect radar antennae equipment from extreme weather conditions at remote defense installations.



The flat-type Speed Nut from which has grown a family of over 6000 types and sizes of spring tension fasteners.

DOMINION FASTENERS LIMITED

Canadian Licensee and Manufacturer of HAMILTON, ONTARIO

TINNERMAN Speed Nuts TRADE MARK a Geo. A. Tinnerman corporation

HOW TO CREATE THE WORLD'S WORST WEATHER

With a twist of the wrist, this "Weatherometer" simulates rain, sun and heat. And, in the Glidden laboratory, it serves a very important purpose.

Inside this cabinet different industrial product finishes can be tested under fantastically extreme weather conditions. Within *days*, the effect of *months* or even *years* of natural weather wear can be precisely measured.

As a result, improved finishes are developed for buildings and products constantly exposed to the varying weather conditions found in any part of the country.

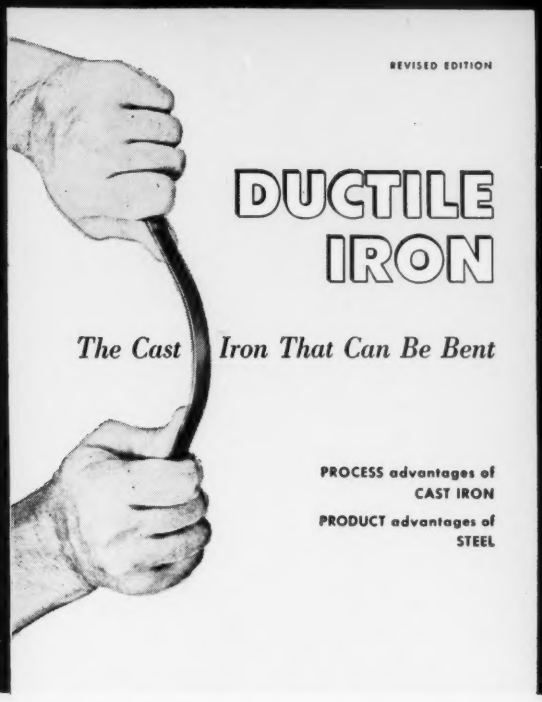
This is another example of how Glidden Laboratories, working to devise paint formulas for every industrial application, can work for *you*. Moreover, the Glidden Technical Service representative is ready to help solve problems of finish application—in your own plant or in the field.

Let Glidden service you in these ways and show you how to cut costs!

QUALITY Glidden PRODUCTS

INFORMATION YOU'LL VALUE! This booklet outlines all Glidden Technical and Laboratory Services—and how you can profit by them. We will gladly send you a free copy—just write to:

THE GLIDDEN COMPANY LIMITED Technical Service Department, 351 Wallace Ave., Toronto, Ont.


REVISED EDITION
DUCTILE IRON
The Cast Iron That Can Be Bent
PROCESS advantages of CAST IRON
PRODUCT advantages of STEEL

FREE! FACT BOOK ON DUCTILE IRON

find out **now** *how Ductile Iron parts can help increase production, cut costs and improve the performance of your products*

Ductile Iron is a type of cast iron that can be twisted and bent without breaking. It has strength and wear characteristics similar to tough steel, and can be cast in intricate shapes as easily as ordinary grey iron.

Ductile Iron has many other remarkable characteristics. It resists heat and corrosion . . . can take heavy shock . . . is extremely easy to machine . . . and can be welded to cast iron or steel.

Six types of Ductile Iron are available, suitable for a wide range of applications. The DUCTILE IRON FACT BOOK contains comprehensive data on all six types, including chemical composition, mechanical properties, general characteristics and suggested applications. One of these types may solve "problem" applications in your operation. To find out how you can use Ductile Iron to help increase production, cut costs and improve the performance of your products, get this free 28-page illustrated FACT BOOK today!

Mail the coupon below for a free copy of
DUCTILE IRON—THE CAST IRON THAT CAN BE BENT

These Canadian foundries are licensed to produce Ductile Iron parts to your specifications.

BELL FOUNDRY CO. LTD.
St. James, Manitoba
CANADA IRON FOUNDRIES LIMITED
Special Products Division
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Vancouver, B.C.
NEW WESTMINSTER FOUNDRY CO., LIMITED
New Westminster, B.C.
OTACO LIMITED
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WELLAND IRON & BRASS LIMITED
Welland, Ontario

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED
25 King Street West, Toronto 1, Ontario.

Sirs: *Please send me a free copy of the 28-page illustrated fact book,* DUCTILE IRON—THE CAST IRON THAT CAN BE BENT

NAME.....

COMPANY.....

ADDRESS.....

CITY..... **PROV.**.....

DK

We own the mint...

ONE DIME

. . . is exactly like the next. But each is a miracle of precision coinage though mass produced.

ONE BEARING

of a given type by MPB is exactly like the next. MPB's coined ball pocket retainers insure precision.

No wonder you find Miniature Precision Bearings the best way to help make your products perform more precisely!

MPB puts the same "coinage" techniques into bearings that make American money the uniformly finest in the world. Each retainer has its own coined ball pockets. Miniature radial retainer ball bearings have smooth, low running torque, even under high thrust loads, because of the unique retainer design. And Miniature Precision Bearings, because they're prelubricated to your specs and individually packaged, assemble in your products so easily that your costs shrink automatically.

If you've got ideas or problems in miniaturization, remember "we own the mint" on the world's broadest miniature bearing experience. More than 500 types and sizes from $\frac{3}{8}$" O.D. *down* — specials if you require.

Write about your needs and get the new MPB comprehensive catalog. Miniature Precision Bearings, Inc., 711 Precision Park, Keene, N. H.

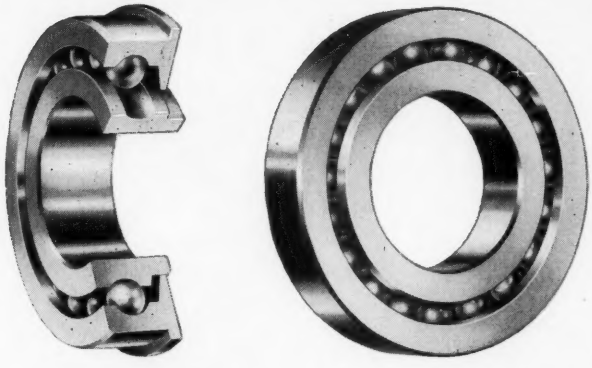
MPB

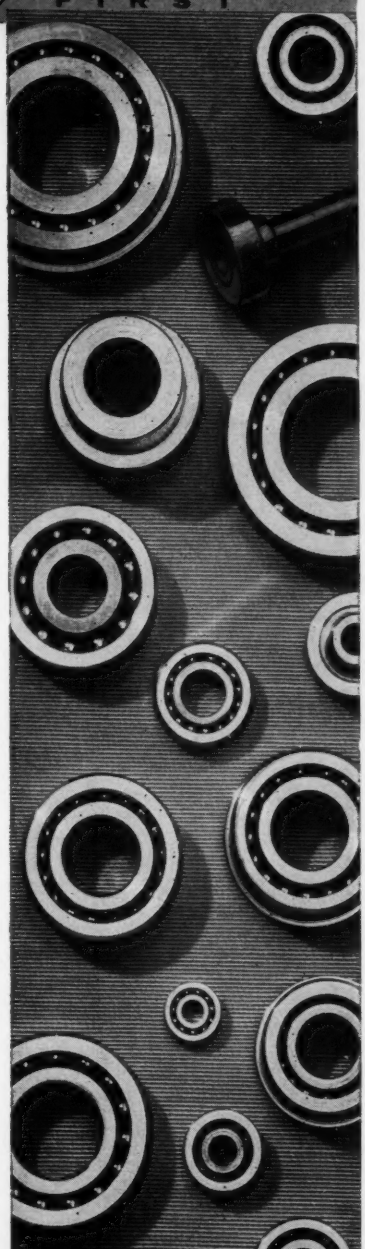
MINIATURE PRECISION BEARINGS

ANOTHER HEIM *Unibal* FIRST

HEIM INTRODUCES THE NEWEST IDEA IN BALL BEARINGS

without insertion grooves or inserts





A most unusual, NEW concept in ball bearing design . . .

Here is a commercial ball bearing with solid, unbroken machined inner and outer raceways, yet with a full complement of balls.

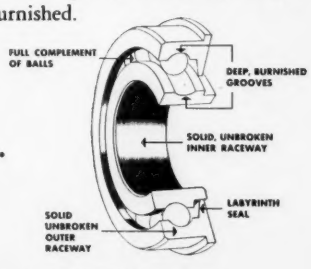
It has deep, burnished ball grooves that are deep carburized and hardened. The revolutionary and radically new method of manufacture permits assembly of these ball bearings in a way that borders on the mysterious and challenges the imagination.

Radial and axial load capacities are increased because of the raceway construction, resulting in longer bearing life.

Unibal Ball Bearings can be furnished in single row, double row and flanged types; to close tolerances on bore and outside diameter; and with controlled radial and axial play.

Close, integral labyrinth seals on one or both sides are another unusual feature, where sealed type bearings are required. Extremely narrow widths and small diameters can be furnished.

NOTE THIS CONSTRUCTION . . .



Special circular with load ratings and dimensions on the new Unibal Ball Bearings is available.

HEIM also makes the Unibal Spherical Bearing Rod End. Send for complete catalog of all Heim bearings. Write direct or see your local bearing distributor.

RBM BEARINGS CANADA LTD.

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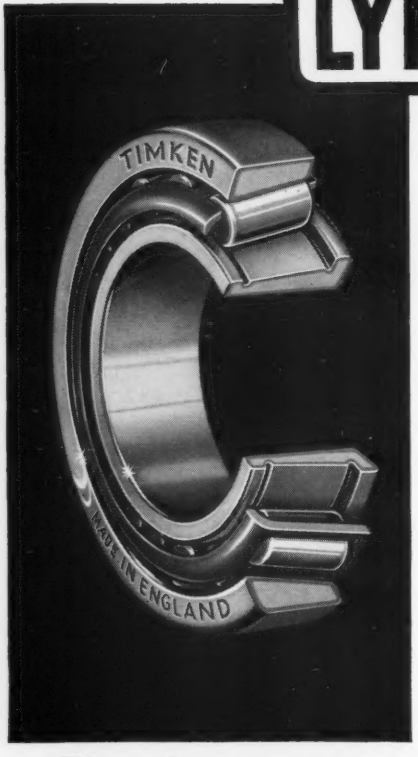
FACTORY REPRESENTATIVES AND DISTRIBUTORS FOR CANADA

THE
LYMAN LINE
OF LEADERS

STILL GREATER LOAD CARRYING CAPACITY

LYMAN



Write or phone your nearest Lyman representative for any information you may require. Our engineers are ready to work with you if desired.

BRITISH

Registered Trade Mark: TIMKEN

TIMKEN TAPERED ROLLER BEARINGS

Made in England by
BRITISH TIMKEN LIMITED

The tendency in many branches of engineering to increase the power, speed or output of a machine, sometimes without increasing dimensions, calls for the highest standard of bearing performance.

British TIMKEN have been constantly engaged in still further increasing the load carrying capacity of Timken tapered roller bearings.

Now, with new and improved methods and machinery, British Timken are able to maintain in wide-scale production those refinements in bearing detail design, accuracy and finish which so greatly influence load carrying capacity.

The resulting increases in rating range from a small to a substantial percentage, according to the particular bearing, and these are shown in a pamphlet which is available on request.

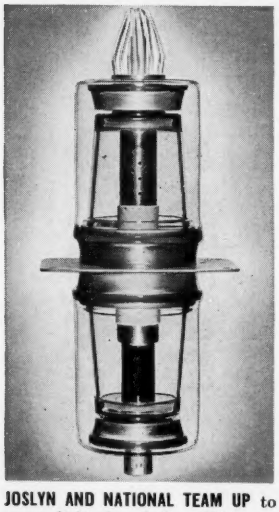
LYMAN **TUBE AND BEARINGS, LIMITED**

Authorized distributors for Canada for British Timken Limited

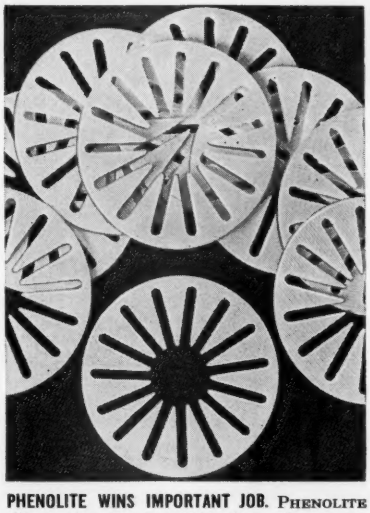
MONTREAL TORONTO HAMILTON LONDON WINNIPEG VANCOUVER
NEW GLASGOW, N.S.

THE NATIONAL SCENE

BIG LIGHTNING HAZARD IN AIRCRAFT, flying through electrical storms, is the radio antenna. Metal skin and structural members insulate the ship against lightning. The antenna—insulated from the metallic skin—provides a path through which current can enter the plane. Simple spark gaps furnish some protection. But they cannot control long, cloud-to-cloud discharges and have never proved fully effective.



JOSLYN AND NATIONAL TEAM UP to tame lightning bolts. With an assist from National PHENOLITE, the Joslyn Aircraft Arrester eliminates lightning hazards—even at high altitudes. Attached to the plane's radio antenna, the arrester permits the flow of radio energy, but blocks lightning discharges and deflects them harmlessly.



PHENOLITE WINS IMPORTANT JOB. PHENOLITE silicone glass Grade G-7-830 forms the separator in the Joslyn Aircraft Arrester—holds essential metal spring contacts in position and acts as an arc barrier. For this, it must have unusual strength, good electrical characteristics, superior punchability—also be fungus proof and withstand severe vibration for long periods. PHENOLITE meets all of these requirements.

NATIONAL CAN HELP YOU

reduce unit product cost or improve product performance at no added cost. Here's why . . . You can select the "one best material" from over 100 grades of PHENOLITE®, Vulcanized Fibre and National Nylon—without compromise in properties or cost. You can simplify production and purchasing with the timed delivery of 100% usable parts—from a single reliable source. You gain competitively with National's new materials and grades—the direct results of programmed materials-research.

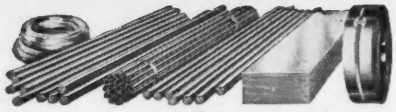
You benefit by calling National first. Check telephone directory Yellow Pages or write Toronto direct. Address Dept. N-11.

NATIONAL

FIBRE COMPANY OF CANADA, LTD.

ATLANTIC & HANNA AVENUES, TORONTO

1411 CRESCENT STREET, MONTREAL

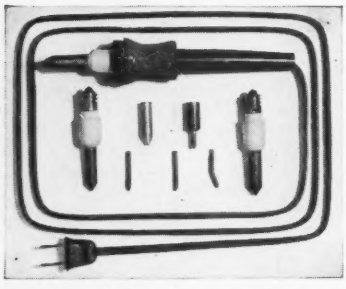


NORANDA COPPER AND BRASS LIMITED

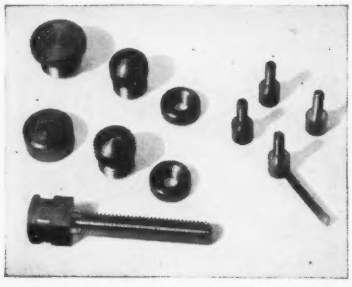
COPPER ALLOY BULLETIN

COPPER Noranda BRASS

MILLS AT MONTREAL EAST—OFFICES IN MONTREAL, TORONTO, WINDSOR, EDMONTON, VANCOUVER
Export Department, P. O. Box 1238 Place D'Armes, Montreal, P. Q., Canada



New lightweight soldering pencil uses Noranda Tellurium Copper tips for easier machining, faster and more uniform heating. (Courtesy, Ungar Electric Tool Co. of Canada, Toronto)



Noranda Tellurium Copper gives machining qualities of free-cutting brass, performance of pure copper to these screw-machined parts.

Noranda Tellurium Copper Offers High Conductivity Plus Machinability

Copper made the practical use of electricity possible. It has always been specified by engineers for the manufacture of components for the electrical industry. New applications are still being found to make use of copper's high electrical and thermal conductivity.

Noranda's research facilities are engaged in a constant search for new materials to satisfy the demands of Canada's expanding industries. For instance, manufacturers of electrical components have been looking for a material that combines the conductivity of copper with the machinability of free-cutting brass. In the past, attempts at alloying copper with various elements have produced a harder material without reducing its characteristic toughness.

In Noranda Tellurium Copper we feel we have the answer. Our engineers have found that the addition of a very small amount of Tellurium to copper raises its machinability from 20% of free-cutting brass to 90%. This is accomplished with negligible effect on its other desired properties.

Using Noranda Tellurium Copper, manufacturers of electrical components can increase screw-machine surface speeds up to four times faster than those recommended for pure copper. Tooling required to work Noranda Tellurium Copper is the same as that used on free-cutting brass.

Noranda Tellurium Copper may be extensively hot forged and, although its ductility is slightly lower than that of pure copper, it can be readily cold worked. All these advantages are gained with electrical and thermal conductivities remaining almost as high as those of pure copper.

Applications

Ungar Electric Tool Co. of Canada, Toronto, uses Noranda Tellurium Copper for tips for their versatile, lightweight electrical soldering pencil for hobby and production line work. A number of interchangeable tips of different sizes and shapes are made from 1/8", 5/16", and 3/8" round Noranda Tellurium Copper rod. Complicated drilling and tapping operations take full advantage of its excellent machinability.

Noranda Tellurium Copper was chosen for other reasons, too. Its high thermal conductivity gives uniform heat at the pencil's tip. It tins more readily than other metals and it is less subject to oxidation. These tips heat to 600° F in 90 seconds.

The second application shown is a series of parts for use in the electrical switchgear industry. These were machined from 3/8" to 1-1/4" round, hexagonal and square Noranda Tellurium Copper rod.

The third example is a holder for a current-carrying bimetal contact. Electrolytic Copper was first specified for this part. Its machining characteristics made the important slotting operation difficult. The problem was solved by using Noranda Tellurium Copper.

Noranda Research and Service

Tellurium Copper is just one of the many copper-base alloys produced by Noranda to solve specific problems. Each is the result of extensive research and development conducted by the Noranda Laboratory in close cooperation with fabricators and users in terms of their requirements.

Noranda Tellurium Copper, or one of the many other engineered Noranda alloys, may well be the answer to your particular problem. Our Technical Service Department and Laboratory will be glad to work with you on the application of these metals to your products. Contact your nearest Noranda Sales Office for immediate service. (2547)

Chemical & Physical Properties of Noranda Tellurium Copper

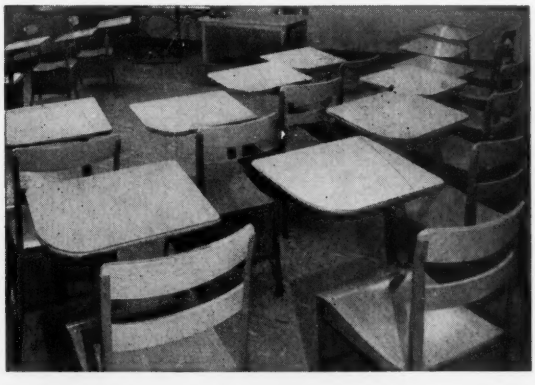
ANALYSIS		
Copper %		99.5
Tellurium %		0.5
MECHANICAL PROPERTIES (rod 1-in. dia.)		
Ten. Strength, psi	Hard	48,000
	Half Hard	42,000
Yld. Strength, psi (½" extension)	Hard	46,000
	Half Hard	39,000
Elong. % (2-in.)	Hard	20
	Half Hard	35
Rockwell Hardness	Hard	B50
	Half Hard	B45
PHYSICAL CONSTANTS		
Specific Gravity		8.94
Density, lb/cu. in.		0.323
Elec. Conductivity, % (IACS at 68 F)		90.0
Thermal Conductivity (Btu/sq ft/ft/hr/F at 68 F		205
Mod. of Elas. (Ten.) 10°psi		17
Coef. of Ther. Exp. (per °F, from 68-570 F) x 10°		9.8
FABRICATING PROPERTIES		
Machinability rating		90
Cold working		Good
Hot working		Excellent
Hot working range °F		1400-1600
Comm. anneal range, °F		700-1200
JOINING PROPERTIES		
Soft soldering		Excellent
Brazing		Good
Inert-Gas Arc Welding		Good

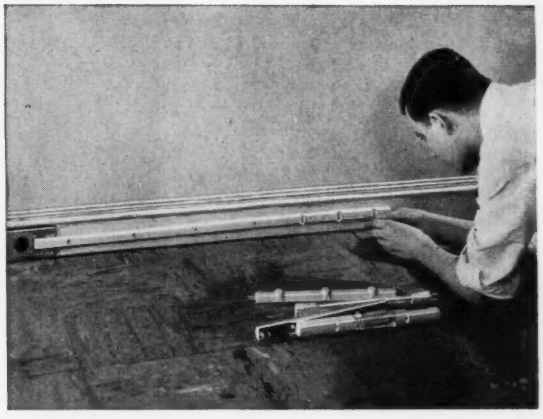
CYANAMID

PLASTICS NEWSFRONT

BABY-FEEDING WARE WITHSTANDS FREQUENT BOILING—AND BABY

Clever design and practical purpose are combined in the attractive baby-feeding ware and educational toys molded by North Star Industries of CYMAC® 400 polymethylstyrene molding compound. Thanks to CYMAC, all pieces are boilable—can be sterilized as often as necessary without distortion, cracking or discoloration. CYMAC upgrades products, provides better quality at competitive cost.





NEW LOW-COST ELECTRICAL OUTLET SYSTEM

Made from ivory-colored BEETLE® urea molding compound, these interlocking foot-long units provide low-cost, easily installed electrical outlets wherever they're needed. BEETLE's strength and excellent insulating properties guarantee safe, dependable service. Its hard smooth surface resists scratching and discoloration. Made by Cable Electric Products Inc., Providence, R. I., this new Snapit Inter-Link system is fully approved by Underwriters Laboratories Inc., a sure indication of its quality and safety.

PLASTIC DESK TOPS HERE TO STAY

"Not a single delamination caused by a faulty glue line" is the proud record of Desk Tops Inc., major supplier of school desk tops east of the Mississippi. URAC® 185 urea resin adhesive is used to bond hardwood plywood cores to rich CYMEL® melamine resin plastic surfaces. These resins are exceptionally strong and are fully resistant to moisture, heat and chemicals. Desk Tops Inc. guarantees tops against glue failure...will use no adhesive other than URAC 185.

1907 1957

NORTH AMERICAN CYANAMID LIMITED
PLASTICS AND RESINS DIVISION

160 BLOOR STREET EAST, TORONTO 5, ONTARIO

CYANAMID Plastics and Resins Division

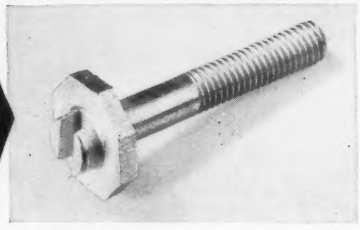
MATERIALS FOR TOMORROW

Two (or more) for the price of one!

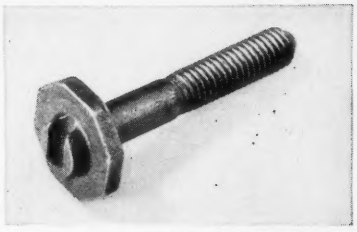
Here's PROOF of savings...

by STELCO COLD HEADING

Manufacturer 'A' saves 50% (approx.) on overall cost

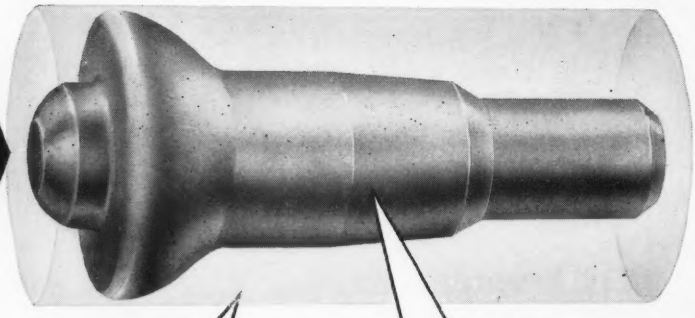


Enlarged view of part previously produced by machining.



Part as now produced by STELCO Cold Heading at half the cost.

Manufacturer 'B' uses 63.5% less material



Material blank previously used for machining (actual length 2¼") .550 lbs.

Finished part, cold headed by STELCO. Material used .200 lbs.

Any part that can be machined from rod stock is potentially suited to production by cold heading. This technique offers speed of production* without scrap loss — and therefore low unit costs. Costs remain attractively low even when one or more secondary operations is required. In addition, cold working increases the tensile strength of the metal, and produces an excellent surface finish.

Quality of cold headed products is high, because metals must be resistant to cracking and free from defects to be satisfactorily upset or extruded cold.

Stelco's Engineers can tell you quickly whether *your* fasteners or contoured parts can be made by cold heading. If so, the savings are likely to be considerable. Send in your specifications with a drawing and an idea of the application, and you will receive prompt attention.

Any Stelco Sales Office is at your service.

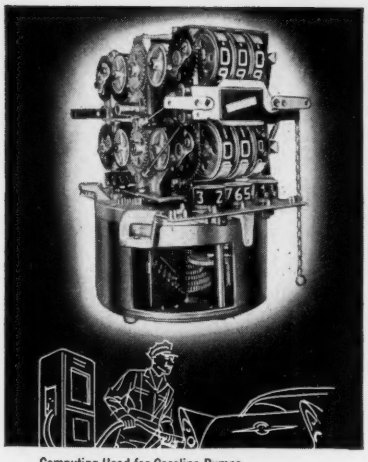
THE STEEL COMPANY OF CANADA, LIMITED

Executive Offices: Hamilton and Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver
J. C. Pratt & Co. Limited, St. John's, Newfoundland

57122.B

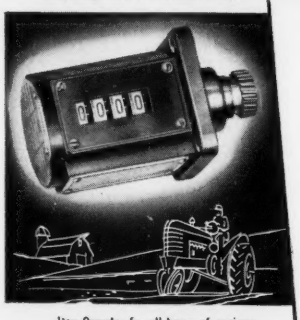
**In one recent instance speed of production was increased from 30 per hour to 6000 per hour by converting from automatic screw machine production to cold heading.*



Computing Head for Gasoline Pumps

"Master Meter Duplicator" prints receipts for fuel oil delivered from trucks

"Vary-Tally" Multi-Unit Reset Manual Counter

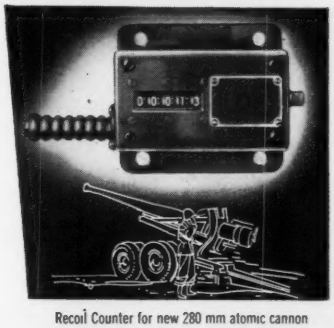


Key-Counter for all types of engines

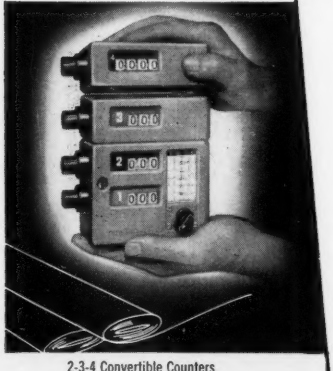
Everyone Can Count on VEEDER-ROOT

Everywhere you look in everyday life, you see a familiar face . . . the face of a Veeder-Root Counter or Computer. From gasoline pumps to fuel oil trucks to textile mills . . . in the home, on the farm, in business and commerce, in modern automated industry . . . Veeder-Root standard and special devices are keeping everything under *Count*rol . . . manually, mechanically, electrically. And the mathematical probabilities are mighty high that *you* can count on Veeder-Root, too . . . to your advantage and profit. Why not let us figure out how, *right now!*

VEEDER-ROOT OF CANADA LIMITED
955 St. James St., Montreal

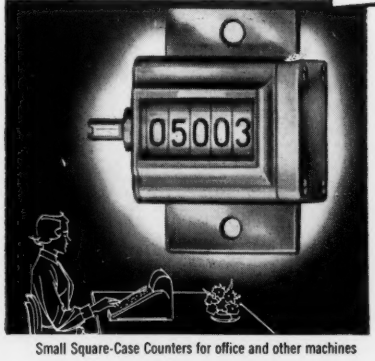


Recoil Counter for new 280 mm atomic cannon

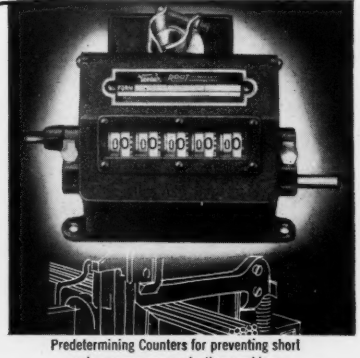


2-3-4 Convertible Counters (and others) for textile machinery

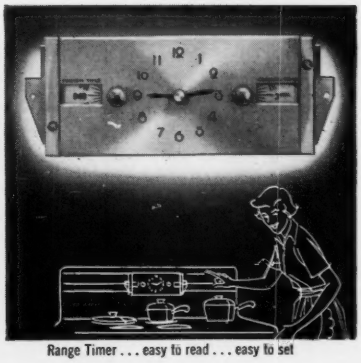
Fuel-Remaining Counter for aircraft . . subtracts as fuel is used



Small Square-Case Counters for office and other machines



Predetermining Counters for preventing short and over-runs on production machines



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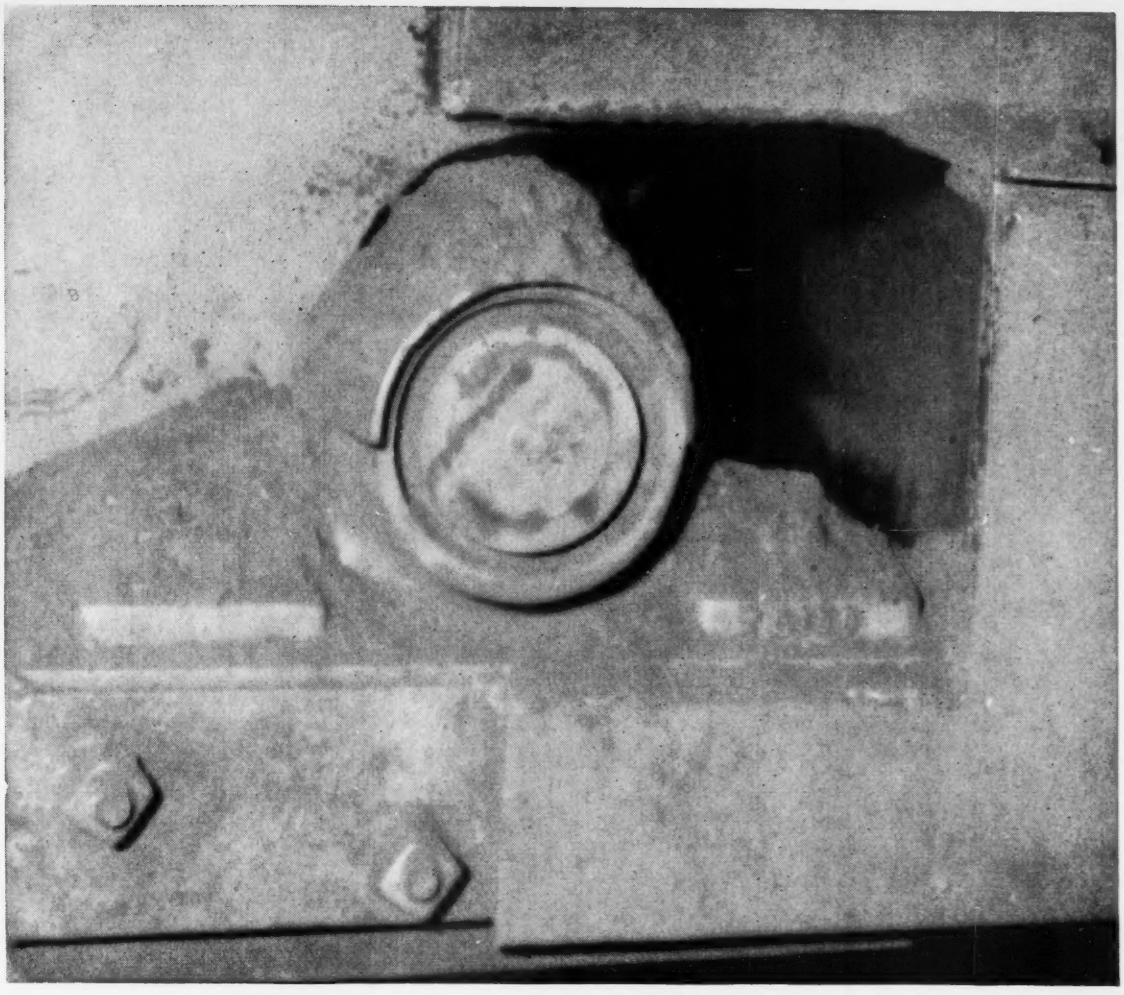
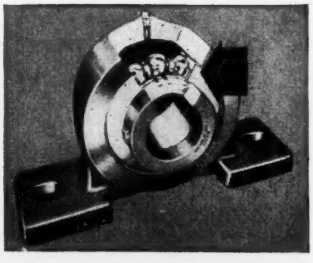


Abrasive sand everywhere... *outside* this Fafnir Transmission Unit



The arrow on the cut-away diagram points to the reason why this Fafnir Ball Bearing Power Transmission Unit excludes dirt and contaminants so effectively. It's Fafnir's efficient labyrinth type seal which effectively retains the factory-packed lubricants while its external slinger throws off foreign materials.

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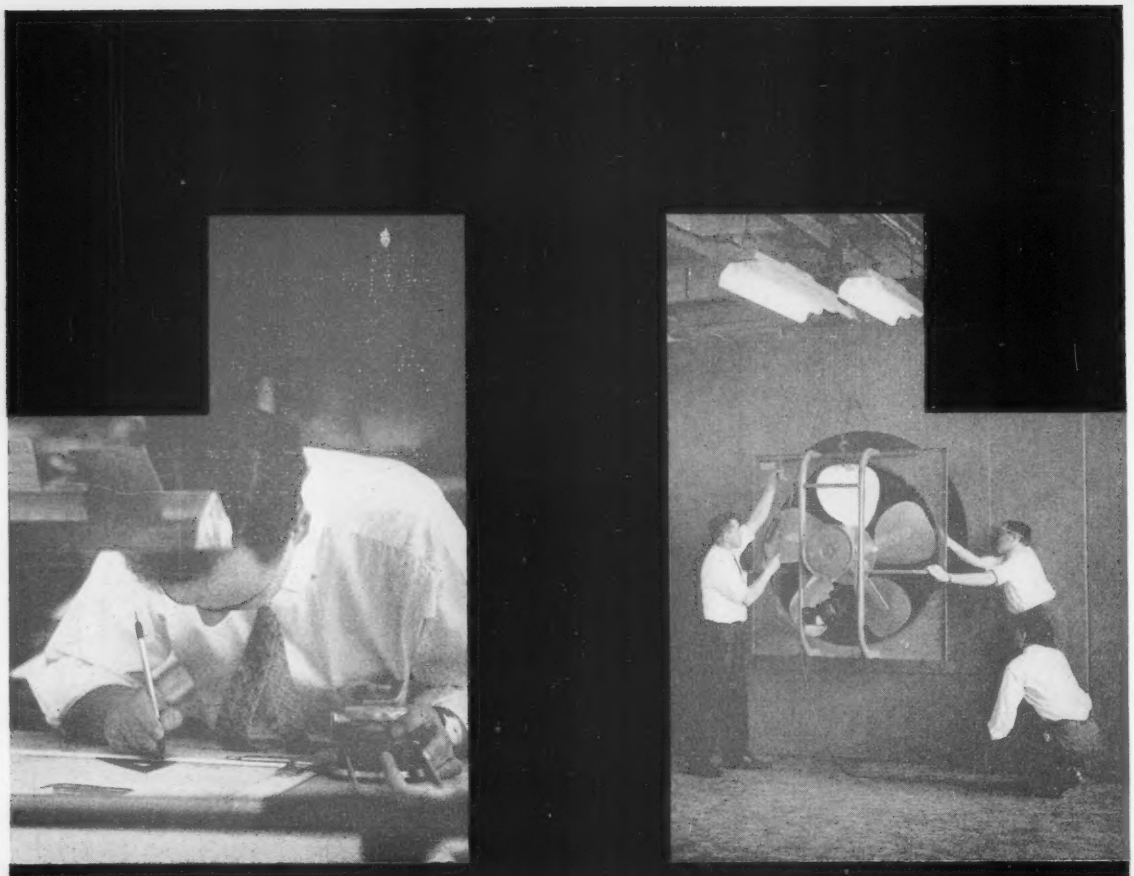

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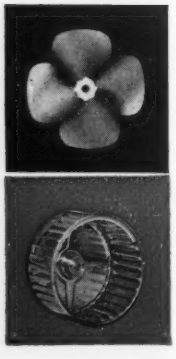

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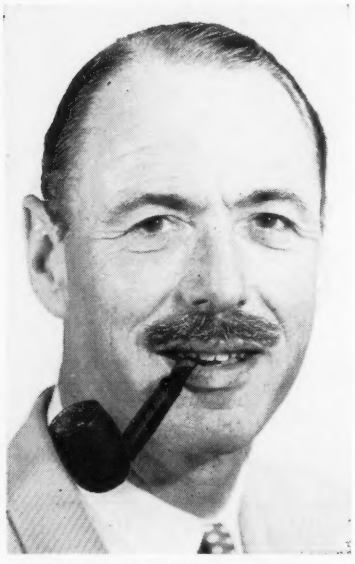
People

Important people who are in the news

Richard Smallman-Tew, P. Eng., chief metallurgist of Avro Aircraft Ltd., is the 1957-58 Chairman of the Ontario chapter of the ASM. Educated at the Royal School of Mines (London University), where he obtained his B.Sc. and A.R.S.M., with honors, he has been a



Member of Council of the ASM for 4 years. He is to be one of the Canadians serving as an American Conferee at the 2nd World Metallurgical Congress to be held in Chicago this month.

H. N. Muller, P. Eng. has been elected a vice-president of the Canadian Westinghouse Company, Hamilton, Ont., according to an announcement by their president, George L. Wilcox.

Mr. Muller, who directs the company's engineering facilities, has been associated with Westinghouse since 1935. He was appointed chief engineer at Hamilton headquarters last year.

He is a member of the Engineering Institute of Canada, a Fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers.

E. C. Fraser, B.Sc., who has just been appointed Eastern Sales Manager, Industrial Division, International Equipment Company Ltd., is a graduate of the University of New Brunswick, which he

entered after serving overseas with the R.C.A.F. Following graduation, he joined the Industrial Division of I.E.C., rising to the position of Chief Engineer before his present appointment.

E. T. Jackalin has just been promoted to Assistant Project Manager of Canadian Steel Wheel Ltd. He has been Development Engineer at Canadian Steel Foundries (1956) Limited since his graduation from McGill University in mechanical engineering.

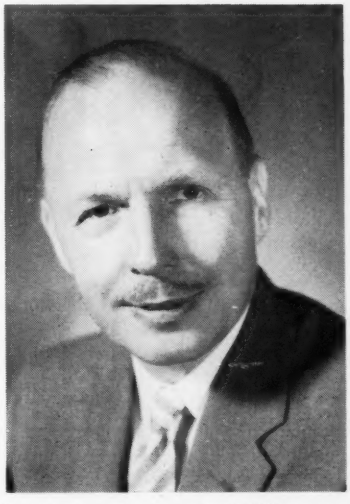
Wally Wilson has just been appointed to the position of district sales representative in Ottawa and Montreal for Bayly Engineering Ltd. of Ajax.

Formerly with the Electronics Branch, Department of Defence Production as senior technical adviser, he has developed an extensive knowledge of the electronics and communications field in Canada, and is widely known in the armed services and governmental departments.

W. G. (Bill) Richardson, P. Eng., M.S.A.E. has just been transferred from the position of Chief Engineer to Sales Engineer on Special Projects, Fruehauf Trailer Company of Canada Ltd.

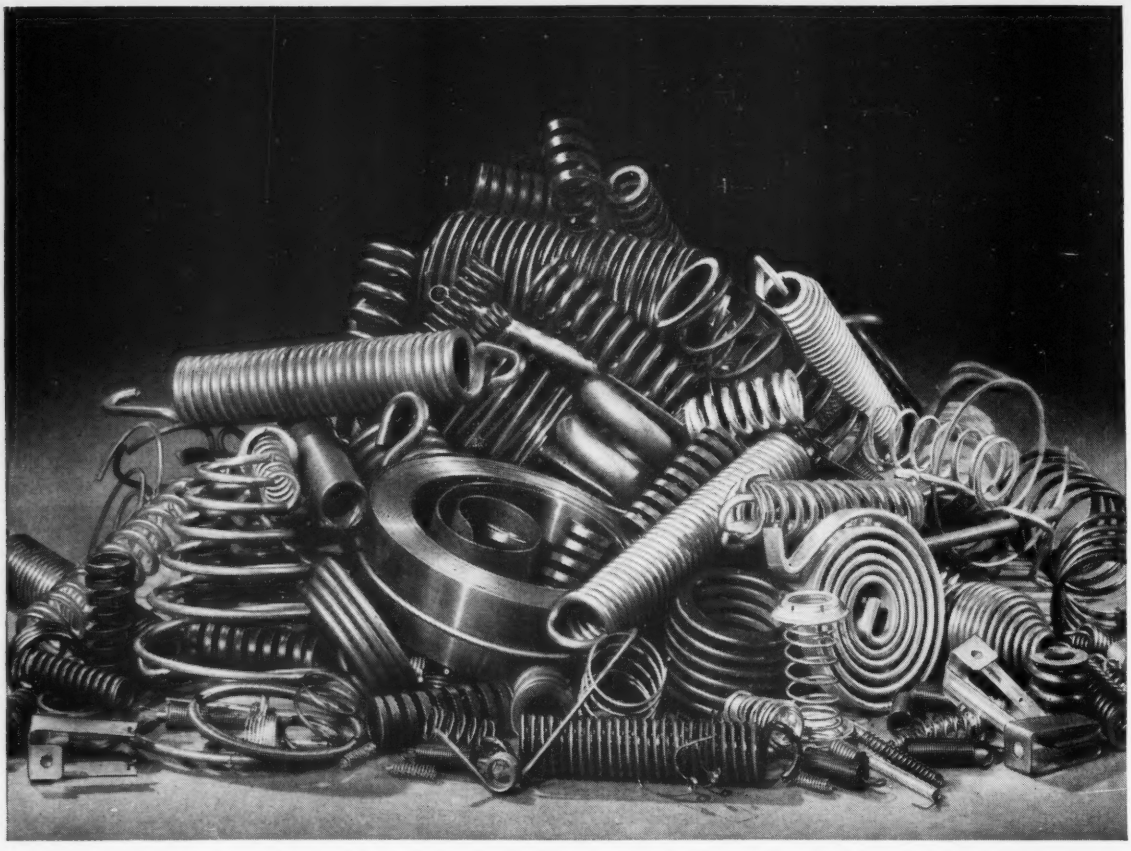
He received his training in England, gaining practical and theoretical experience in industrial refrigeration and oil pipeline equipment. Since coming to Canada in 1948 (and prior to joining Fruehauf) Mr. Richardson worked as a designer on snow ploughs and allied hydraulic truck equipment. He joined the company in 1951 and served as Tank Engineer for one year prior to his appointment as Chief Engineer, the position he has held since.

C. L. Moon, P. Eng., a graduate of the University of Toronto in Mechanical Engineering, has just been appointed Chief Engineer of the Fruehauf Trailer Company of Canada. He brings to his new position widely diversified experience in design, manufacturing and administration. Commencing with the appliance industry in 1934, Mr. Moon has worked



in the farm implement, building construction, prefabrication and aircraft industries. He comes to the Fruehauf organization from Avro Aircraft Ltd. (where he was in charge of engineering standardization) and is widely known in that industry as a result of his activities in engineering and standardization committee work.

Donald C. McCormack, Manager, Product Development and Engineering for J. A. Wilson Lighting and Display Limited, was recently elected President of the Association of Canadian Industrial Designers for a period of one year.



needle in a haystack?

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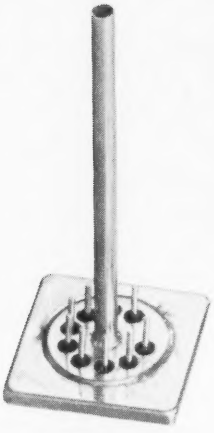

The big advances in hermetic sealing are recent

Developments in glass-to-metal sealing are now resulting in a mass of new applications

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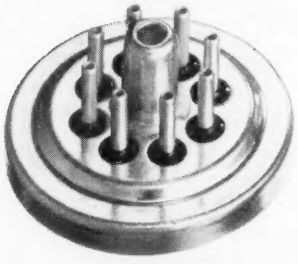
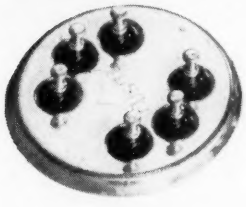




The past three years have seen the greatest advances to date in the field of glass-to-metal hermetic sealing.

In World War II there were a few applications for this type of seal but the method was expensive and used only when it was absolutely necessary to seal a component from the outside atmosphere, foreign particles or fumes.

It was in the postwar years that development in the refrigeration and electronics industries really started. Even then, it was widely believed that glass was too fragile and required special techniques to prevent breakage.

Like other industries, glass-to-metal sealing followed a pattern. First were the experimental years, then the test years for acceptance of the product and finally widespread production use.

The first good hermetic seal was fine from a corrosion standpoint. It also had excellent insulation resistance and flash over. The glass was fragile, however, and had to be "babied" through production lines. Our basic terminal (begun in 1943) had good heat shock, but was low on insulation resistance. At room temperatures, it was excellent. The heat shock factor made the terminal tough and it came into wide use. However, we did not consider this the ultimate in glass-to-metal sealing.

In 1953 the compression type terminal was introduced. As the name implies, this was formed under tremendous compression. When thus confined, it was necessary to have a heavy metal ring

surrounding the body of glass to obtain this compression. Fusion is lacking between metal parts and the glass. This was a serious drawback, because compression is achieved by the metal parts and the glass pushing against each other. Once relieved, cracks and leaks are prevalent. Even so, they are more rugged than previous terminals.

One major reason for the success of the compression terminal is the grouping (in one piece of glass) of more electrodes than can be obtained in multiple bead extruded-type terminals. This has become a factor due to the trend toward miniaturization in electronics.

However, there were still problems to be licked. We believed that it was absolutely necessary to develop a glass that would withstand tremendous mechanical and heat shock without cracking. Our research team tackled this problem and, after many experiments, came up with the right formula. We call this V-24 glass.

It combines both fusion and compression. Normal controlled compression techniques are used but, in addition, true fusion is accomplished. This results in an interfusion of glass and metal oxides at the point where the metal and glass meet. This is the best combination of factors to produce a true hermetic terminal.

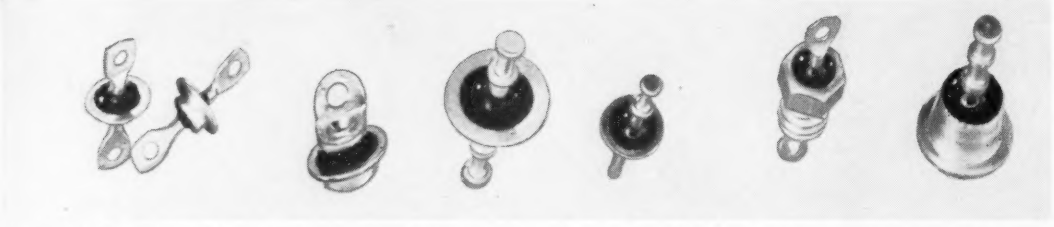
As the demand for hermetically sealed compressors rose, so did the use of hermetic terminals. Today, there are some 17 million in use. These are, however, confined to fractional hp units.

The growing demand for air-conditioning units prompted the need for higher hp terminals. To meet this, we developed a terminal similar to the fractional hp units, but with added glass extensions on the outer surface. This has successfully met various Underwriters' Laboratories specifications due to higher flashover characteristics.

Since normal wire is not sufficient to carry these higher hp, it is necessary to use an electrode made of ⅛ in. diameter alloy wire with a copper core running the full length. With this copper core, the terminals will carry 55 amp at 230 or 440 volts well. Horsepowers of 3, 5, 7½ and 10 can now be carried. This advance is resulting in large cost savings for manufacturers of air-conditioning hermetic compressors.

Glass-to-metal fused terminal developments depend on two things: better glass and the growth of the electronics industry.

There are several types of glass in production today. They can meet almost any specification for military or industrial use. Insulation resistance is up to 100,000 megohms at 150 C. Flashover depends on the particular terminal selected. With new designs in glass, this



A selection of the single electrode type of hermetic terminals. The multiple type is shown on the previous page.

This new terminal is rugged. Since all the glass is confined within a metal ring to form a solid glass header, there is very little (if any) protrusion of glass above this ring. This makes the terminal crack-free, stronger and easier to use on the production line. This type is also being produced in individual extrusions where lightness and toughness are necessary factors.

To meet mechanical and heat shock specifications, certain tests are used. It is still necessary to overcome the idea that glass is fragile.

Samples are taken at intervals from the fusion ovens. They are placed in an induction heater to simulate actual production-line soldering. Heat is applied, so that the temperature reaches 500 F in approximately 10 sec. Then the terminal is allowed to cool to ambient temperature, after which it is put under pressure (the amount depends on its end use) and leak tested.

Other terminals, with thicker metal stampings, are tested to 10,000 psi. After these shock tests, the terminals are microscopically inspected for cracks. None are allowed.

Our experience indicates that terminals withstanding these tests can safely be put in a production line without the need for undue care. In the field, they will withstand atmospheric differences and corrosion for many years.

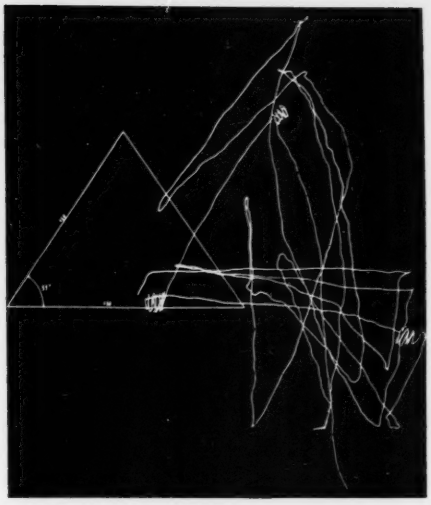
The second major development of the past 3 years is the higher hp terminal for the refrigeration industry. is far beyond old limitations.

Compared with a few years ago, these are high standards. Yet we have requests for glass to withstand 200,000 to 300,000 megohms resistance at 500 or 600 F. Terminals to withstand operating temperatures in this range must have heat shock characteristics far in excess of terminals in use today.

When these temperatures are finally achieved, it will be necessary for electronic users to weld the terminal to the component instead of soldering it, as is done today. This also applies to lead wires to the terminal electrodes. Today, terminals are available that are shielded-arc or resistance welded into the component. However, the glass portion of the terminal is far enough from the weld to dissipate excess heat.

There is a rising demand for multiple-bead, extruded, light-stamped type terminals. This is based on weight consideration—a big factor in high altitude aircraft and guided missiles. Many of the characteristics of the compression type terminals are also built into these.

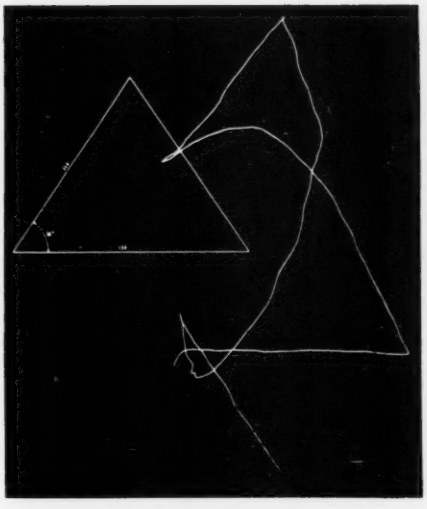
Future development will undoubtedly meet the new requirements. The industry has advanced rapidly, until today there are terminals that can withstand practically any mass production technique, having better mechanical shock, better electrical qualities and higher temperatures. They have cut manufacturing costs by as much as 25%, compared with previous sealing methods. ★



Light squiggles trace the path of the right hand as it draws a triangle on the board.

Bad equipment can keep draftsmen tired

Using a modern drafting machine instead of T-square and set square gives this result.



This article, based on a series of tests, clearly shows the advantages of the drafting machine at adjustable boards

The aim of every manufacturer is a product that will sell. In spite of this, the factors that contribute to the comfort and efficiency of designers and draftsmen (with whom rests the responsibility of creating saleable products) are so often ignored.

This article is based on a report of tests carried out by the Battelle Institute of Columbus, Ohio, and points to the need for thought on the subject of production in the drawing office where all production begins.

Just how big a part does the draftsman's equipment play in his efficiency? For the purpose of tabulating results, each type of test equipment is indicated by the initial letter shown.

TH. T-square and set squares on a horizontal board.

PH. Counterbalanced parallel motion and set squares on a horizontal board.

PU. Counterbalanced parallel motion and set squares on an upright adjustable board.

DH. Standard drafting machine on a horizontal board.

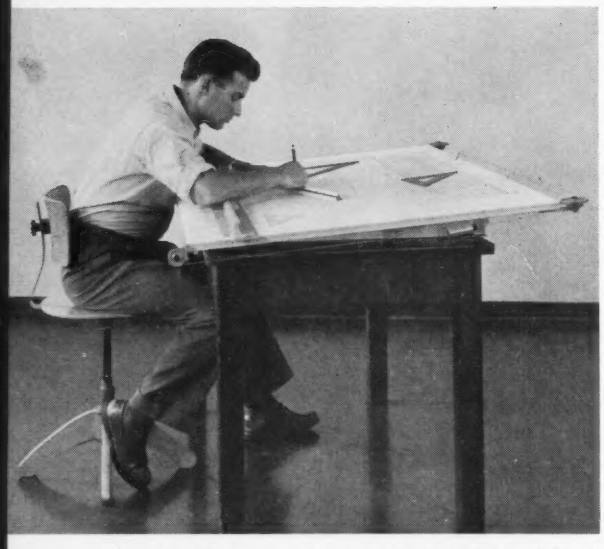
DU. Standard drafting machine on an upright adjustable board.

DZU. Drafting machine with an adjustable zero head on an upright adjustable board.

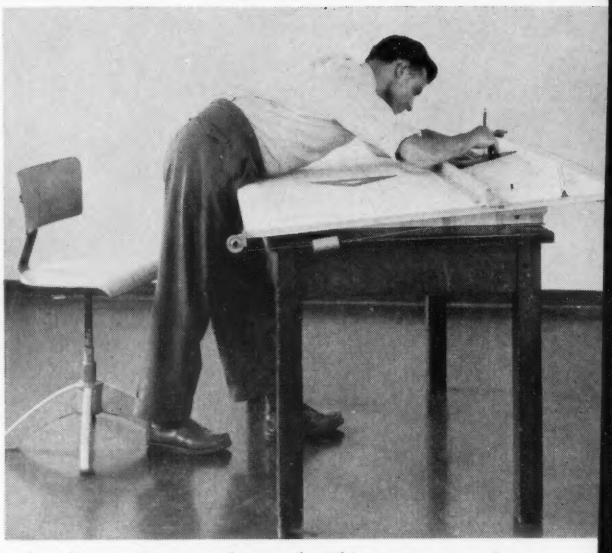
Test drawings made included an uncomplicated engine part, an architectural drawing and a fairly difficult assembly drawing with main group arranged about centre lines inclined at different angles.

To create a measuring standard, the average time

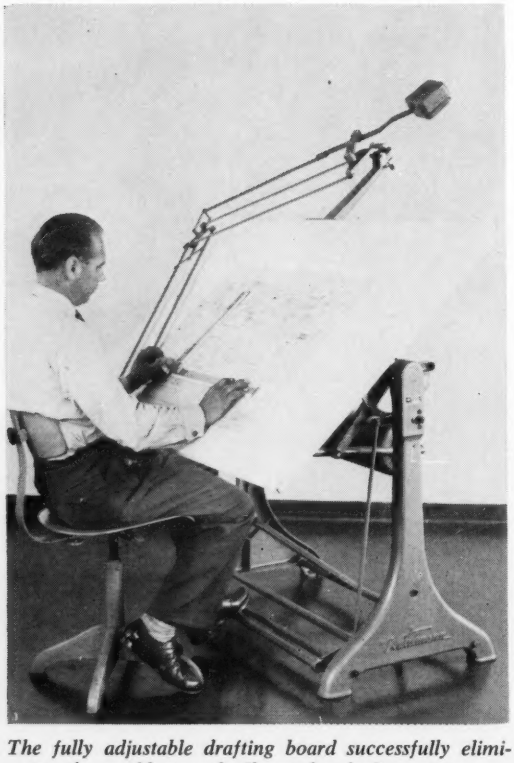
In spite of the fact that most manufacturers' products originate in their



When the draftsman sits at a horizontal board he is unable to reach the top third of his drawing area . . .



unless he stands up to his work. This means a strain on the back muscles and possible smudging of his work.



The fully adjustable drafting board successfully eliminates the problem and allows the draftsman to . . .

draw on the bottom, centre or top of the board without making a move. Tilting the board does the trick.

drafting office, draftsmen seldom get the equipment for top quality work

taken to produce the first drawing was estimated, each draftsman using a standard drafting machine at an upright adjustable board. This average time of 55 minutes is expressed as 100% in the tables below and is compared proportionately with the times taken to produce the same drawing using the various other test equipment.

Drawing equipment	DU	PU	DH	PH	TH
% Working time	100	117	123	128	139

This test clearly shows the advantage of the drafting machines at an upright adjustable board. It is interesting to note that the test was completed in faster time with the parallel motion unit and an upright board than with a drafting machine at a horizontal board, indicating that for this test, board position was more important than the drafting machine.

Most of this drawing was concentrated between 19¾ in. and 23½ in. above the lower edge of the board. Working at horizontal boards, draftsmen were forced to bend and could rest their arms only temporarily. Neither hands nor arms could be rested on the board while drawing and the considerable strain involved no doubt accounts for the increased time taken under such conditions.

The second test was designed to produce conditions said to favor the use of T-squares and parallel motion units.

It has long been held that the drafting machine cannot compete with this equipment where the design demands the drawing of long horizontal lines. But the test drawing disproved this theory. In fact, test drawings produced with a parallel motion unit at an upright board required 25% more time, and with a T-square 31% more time, than with the drafting machine. The final test drawing was of a four stroke internal combustion engine. The results show great advantages in the use of drafting heads with adjustable zero for this type of work. These heads permit the necessary contant change of drawing base angles without calculation. Actual times were as follows:

Drawing equipment	DU	DZU	PU	PH
% Working time	100	84	120	141

The above individual tests and the following figures prove conclusively that the drafting machine on an upright adjustable board is the most suitable equipment from the aspect of speedy working.

Drawing equipment	% Working time simple drawing	% Working time difficult drawing	Mean % work time
DU	100	100	100
DZU	100	84	92
PU	115	125	120
DH	120	130	125
PH	130	140	135
TH	130	150	140

To eliminate the fatigue factor, short tests of one minute were carried out and in order that only the purely mechanical work of drawing was involved, each draftsman was allowed practice time on each piece of equipment making drawings of the simple figures chosen for the test.

As in previous tests, the time taken when using a standard drafting machine and an upright adjustable board, were taken as the measuring standard and are again expressed as 100% to the following tables.

Examining these figures it will be seen from DU, DH and PU, PH that board position has made little difference to the working times with similar equipment. The mean times for PH, TH, PU are similar but they are more than 100% longer than those for DU and DH, thus proving absolutely the simplification of work made possible by the drafting machine.

Drawing equipment	Triangle	Rectangle	Mean % working time
DU	100	100	100
DH	98	99	99
PH	210	200	205
TH	225	194	210
PU	247	189	218

The movement diagrams in figure 1 illustrate that even on the most simple drawings, the drafting machines can save a great deal of movement and so reduce fatigue. Results from 10,000 tests made on horizontal boards, show that between 50 and 75% of drafting errors and inaccuracies occur when working at the top of the board where maintenance of a convenient working position is most fatiguing.

The draftsman's working position and the equipment he uses has an effect on his health also, quite apart from its influence on his efficiency.

The tests carried out by Battelle were not of long enough duration to reach definite conclusions but the following observations are nevertheless of interest.

Four working positions were involved in these tests —sitting or standing at a horizontal board and sitting or standing at an upright adjustable board.

When working at a horizontal board the draftsman perspired more freely and both pulse and respiratory rates increased.

This rate increase lasted for an average of four to six minutes before being returned to normal by the body's regulating function.

Interviews with 300 draftsmen produced information on the incidence of common complaints and are shown as percentages in the following table.

	Horizontal Board		Upright Adjustable Board	
	Sitting	Standing	Sitting	Standing
HEADACHE	52	47	36	31
BRONCHITIS, COLDS	38	59	29	21
CONSTIPATION ...	29	44	22	14
BACK ACHES	14	50	24	14
FOOT COMPLAINTS	10	31	18	27
MEAN VALUES ...	29	46	26	22

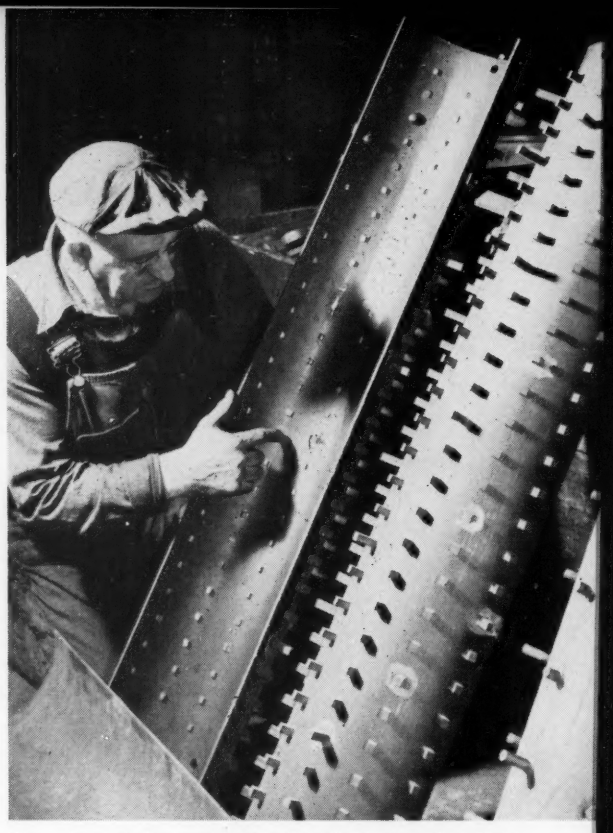
(Continued on page 75)

Stud welding

End welding method possessing a design potential

Simplicity in design and manufacturing methods and a saving in weight are a few of the benefits

R. C. Singleton GREGORY INDUSTRIES INC.

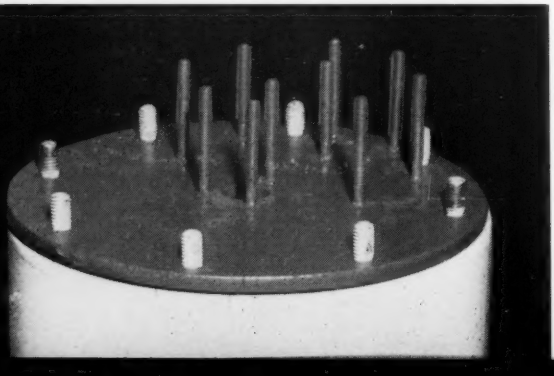


Cost of applying end welded studs is less than half that of attaching square upset rivet teeth as before.

Stud welding is a speedy electric arc welding process that has become established in the past decade, through research, market development and performance in practically every industry where metal is used, worked or joined.

For several years after World War II, the majority of applications were simple substitutions of end welded studs for such other fastening methods as drilling and tapping, hand welding, tack welding and through-bolting. Even with this limited approach, new applications opened up literally every day. As a rule of thumb, it was estimated that the process saved industry something like five (or even ten) dollars for every dollar invested in studs.

Today, however, the scope of stud welding has become vastly enlarged through recognition of its design potential. It permits the basic redesign of many different types of equipment and thus leads to greater simplicity, lighter weight and simpler manufacturing methods. These improvements usually lead to appreciable savings in materials and labor. In addition (and perhaps more significant) stud welding frequently permits designs that are simply impossible with other fastening methods.



These studs are end welded with speed and accuracy by a Nelson unit. Studs are ¼ in and ½ in diameter.

The physical reasons for stud welding's inherent advantages may be summarized thus:

1) It is rapid, end welding of five to ten studs per minute being common;
2) It allows fasteners to be located almost anywhere, without regard for such common design problems as bolt-hole-to-edge distances;
3) It is a one-side operation that requires no puncturing of a metal surface and little concern for what is on the far side of the work;
4) It uses studs of great variety in shape and size; and
5) It permits the joining of many common alloys, including stainless steels and such nonferrous alloys as monel, inconel and aluminum.

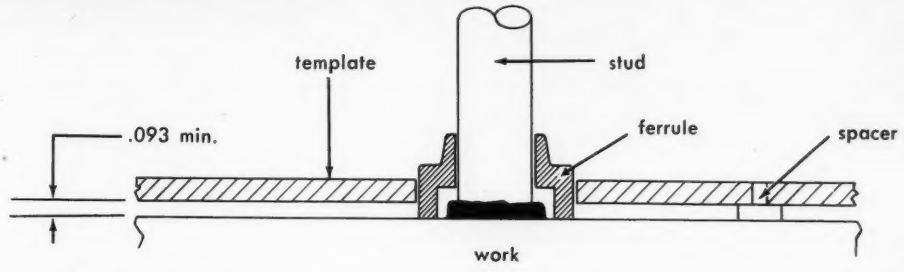
Most stud welding is performed with a lightweight, highly portable gun weighing about 5 lb, and is governed generally by the same rules that apply to any electric arc welding processes.

The newest gun (introduced this year) weighs less than 5 lb and will weld the great majority of studs up to ½ in. diameter. A larger gun is used for weld base diameters up to 1 in.

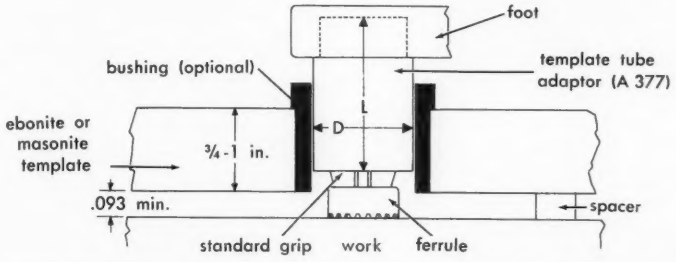
Production units (using one or more rigidly mounted guns actuated by pushbuttons or foot levers) are available for rapid, repetition welding or maintenance of close tolerances.

In most cases, the actual weld requires only a fraction of a second and the joint obtained is a true weld in every sense. The stud is thrust automatically into a small pool of molten metal which is created by an

Template design



This method of templating is recommended for use with F-105 or F-305 ferrules. The template is usually a steel plate 3/32 in. to 3/16 in. thick. Spacers are required to allow the gases to escape during the welding cycle. The ferrule can be held by a standard ferrule grip or, where cleearance is prohibitive, a tube type set-up can be used. The recommended hole sizes on the template to locate the ferrules should equal the maximum outside diameter of the ferrule plus 1/32 in. Holes may be drilled or bored.



stud size	D	L
½ in. and under	1.250	2.000
⅝ in. and ¾ in.	1.562	2.500
⅞ in. and larger	2.125	2.500

This is the method of templating recommended for use with all stud styles. The design makes it possible accurately to hold angular alignment of the studs as well as stud location. The template should be made of ebonite or masonite of a thickness sufficient to afford good alignment. Bushings may be used to ensure greater accuracy and extend the life of the template. Standard copper ferrule grips are used with the tube adaptor. This permits standardization of templates, since it is only necessary to change the copper ferrule grip to weld studs of different diameters. The hole diameter of the bushing or template should be approximately .010 in. larger than the maximum outside diameter of the adaptor.

electric arc between the stud and the work. A ceramic ferrule (or arc shield) is used to concentrate the heat and form a fillet of weld metal around the base of the stud.

Since stud welding eliminates the need for drilling, or punching holes to accommodate fasteners, the advantages obtained by designing with the process in mind include the elimination of heavy bosses and flanges normally required for tap depth; reduction in weight and simplification of jigs, fixtures and other tool assemblies; elimination of leaks in oil or watertight containers; and freedom of placing attachments.

Although end welded studs are available in many sizes and shapes, experience has shown that the great majority of design needs can be met with studs of standard types and dimensions. Furthermore, standardization to the greatest extent possible will obviously result in maximum economies. Standard stud types are generally cheaper and are available immediately from stock. Frequently a minor design compromise in dimensions will permit the use of standard studs.

Table 1

Welding capacity of various power resources

Stud weld base	Up to 7/16	1/2	5/8	3/4	7/8	1
400 amp NEMA rated dc welder	■					
600 amp NEMA rated dc welder	■	■				
2—400 amp welders in parallel	■	■	■			
2—600 amp welders in parallel	■	■	■	■		
Nelwelder Model B battery unit	■	■				
Nelwelder 1000 power unit	■	■	■			
2—1000 power units in parallel	■	■	■	■		
Nelwelder 2000 power unit	■	■	■	■	■	
2—2000 power units in parallel	■	■	■	■	■	■

Stud welding continued

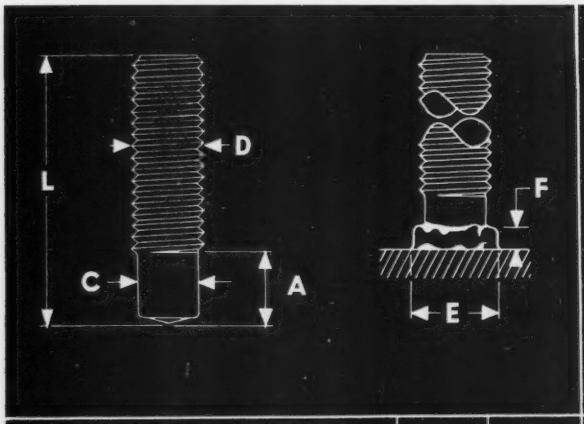
Whenever different sized studs are welded, adjustments must be made in the equipment or in the welding setup. While simple enough to make, these adjustments take time and cost money.

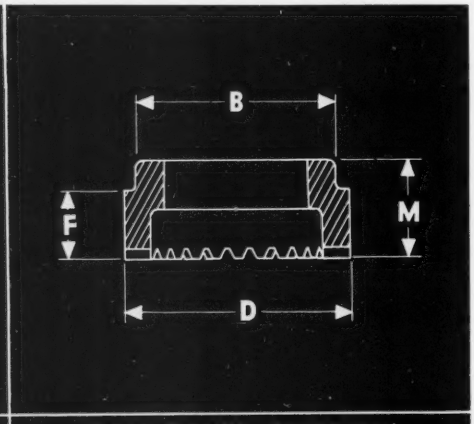
Another economy tip for designers is to know the welding power required for studs of given weld bases. This information (listed in Table 1) will help avoid unnecessary delays or difficulties in the shop or production schedule.

Stud welding requires a source of dc welding current. The most satisfactory source is a unit designed specifically for stud welding, but conventional dc motor-generator welders, gas-driven dc welders or rectifier units also may be used.

It should be noted that the table shows maximum capacities of the power sources. However, capacities of individual machines may vary with the length and size of cable used between the generator and the work,

Table 2





STANDARD STUD DIMENSIONS				E	F	F-239 FERRULE DIMENSIONS			
D Thread Diameter	C	A	L Recommended Min. Standard	Weld Fillet Diameter	Weld Fillet Height	B ± .010	D ± .015	M ± .015	F ± .015
1/4	.215	.375	.630	.313	.093	.380	.455	.250	.125
5/16	.275	.375	.678	.406	.109	.445	.535	.250	.125
3/8	.330	.385	.848	.469	.109	.505	.595	.264	.139
7/16	.387	.438	.930	.532	.125	.585	.675	.329	.173
1/2	.448	.500	1.027	.594	.156	.650	.740	.362	.206
5/8	.562	.625	1.209	.750	.187	.785	.905	.433	.277
3/4	.680	.791	1.443	.921	.250	1.030	1.150	.526	.339
7/8	.798	.858	1.618	1.046	.312	1.210	1.330	.593	.406
1	.915	.926	1.793	1.187	.343	1.406	1.526	.661	.474

Standard Threaded Studs, Type CPF, have a pitch diameter weld base (C). They are available in diameters ¼ in. through 1 in. All orders for studs include required ferrules.

Length: Available in required lengths above recommended standard minimums (L). Length is before weld. Stud diameters ½ in. and below will be approximately ⅛ in. shorter after welding. ⅝ in. and above will be approximately 3/16 in. shorter after welding.

Thread: Standard thread is UNCA2A. Maximum standard thread lengths is 3.000 in.

Material: Low carbon steel.

C: .23% max.
Mn: .60% max.
P: .040% max.
S: .050% max.

Nelson studs are also available in stainless steel, Type 304 being the most commonly used.

Mechanical properties (as cold drawn)

Tensile ..... 70,000 psi min.
Yield ..... 60,000 psi min.
Elongation ..... 20% min.

Weld Fillet: Weld fillet diameter and height dimensions (E and F) are the maximum size of fillet when a weld has been properly made. A good weld is the result of following operating and equipment maintenance standards and procedures.

Plating: If plated studs are required, cadmium is used to ASTM specification A165-55 Type TS. Plating is removed from the welding end of stud to prevent weld contamination. Information on other plating materials available upon request.

Annealing: To increase stud ductility, studs can be annealed to 75 Rockwell B max for low carbon steel studs or 90 Rockwell B max for stainless steel studs.

incoming power conditions, condition of the equipment and the position in which the weld is made.

A great many variables enter the picture when the designer considers stud strength factors. As the strength of the weld exceeds that of the stud, the basic strength factor is therefore the minimum cross-sectional area of the stud. A good guide (generally on the conservative side) is provided by handbook values for mild steel bolts. Obviously, however, stud strength will vary with the steel stock, thread finish, lubrication, washer type, hardness and many other factors. A stud should never be used at its yield load. It is generally recommended that studs be used at no more than 60% yield. The factor of safety may vary up or down, however, depending on the kind of application and the duty the studs are performing.

When a stud is end welded, a fillet forms around its base, with the fillet dimensions being closely controlled by the design of the ferrule used. Since the diameter of the fillet is generally larger than the diameter of the stud, some caution is required in the design of mating parts. Counterbore and countersink dimensions will vary with studs and ferrules, but for examples see Table 2 for dimensions when standard Nelson Type CPF studs of common diameter are used.

Related to the problem of accommodating fillets is that of locating studs on the work. Basic advantages of the stud welder are its light weight and portability which permit its being carried easily to heavy or bulky work. This feature frequently results in substantial savings in production time and handling costs.

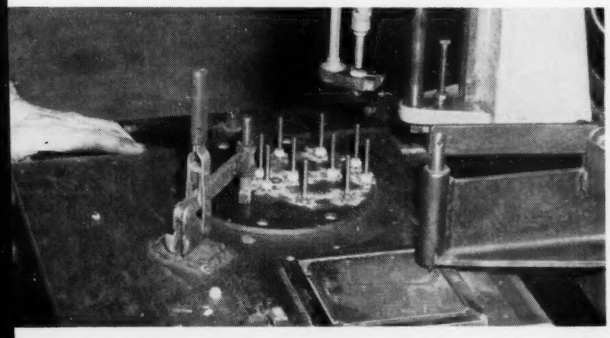
The simplest and most common procedure for locating studs is to lay out and centre punch or to centre punch through holes in a template. The point of the stud is then placed in the punch mark. Although the skill of the operator is always a factor in accuracy, this method usually results in tolerances of ± 3/64 in.

Where a number of similar pieces are to be stud welded, it is common practice to weld directly through holes in a template without preliminary marking or punching. Because there are tolerances in the dimensions of the ferrule itself, this method should not as a rule be used if stud location tolerances must be better than about 1/32 in.

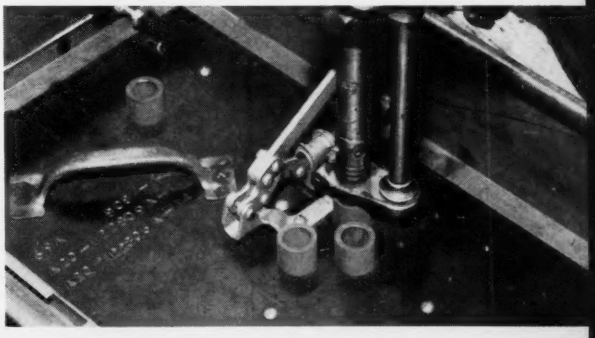
Two basic designs of template are shown. In the simpler one, the template is usually a steel plate 3/32 to 3/16 in. thick. Spacers are required to allow the gases to escape during the welding cycle. The recommended hole sizes on the template to locate the ferrules should equal the maximum outside diameter of the ferrule plus 1/ 32 in.

The other method of templating shown permits holding the stud in accurate angular alignment. The template is generally made of ebonite or masonite, of thickness sufficient to afford good alignment. Bushings may be used to insure greater accuracy and to extend the life of the template. The tube adaptor is attached to the base of the gun. Standard copper ferrule grips are used with the tube adaptor. In this way, standardization of templates is permitted since it is only necessary to change the grip to weld studs of different diameters. The hole diameter of the bushing or template should be approximately 0.010 in. larger than the maximum outside diameter of the tube adaptor. ★

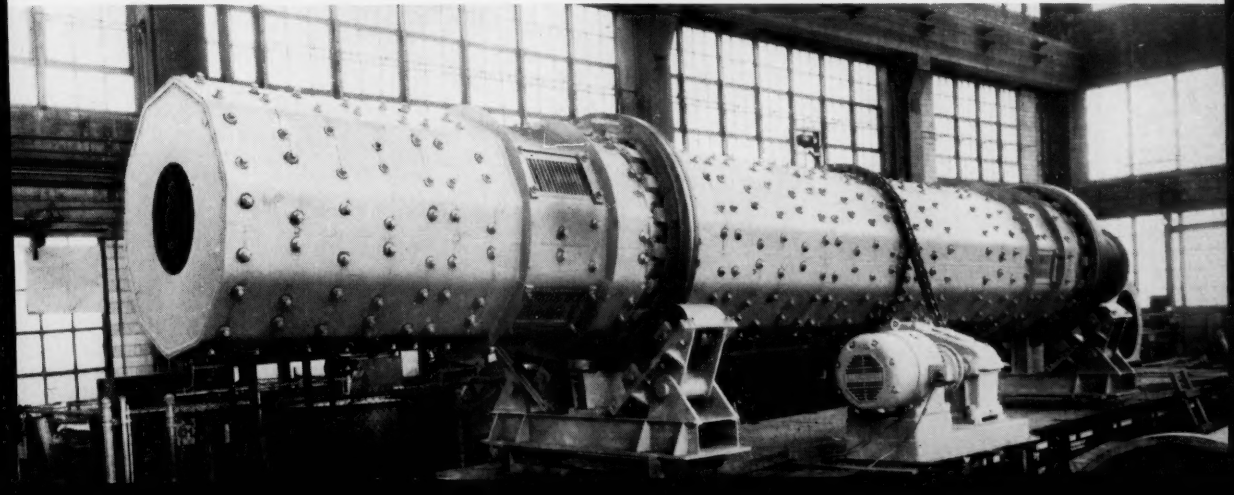
A Nelson stud welding production unit shown in use.



Close-up shows a template with the bushings in place.



This tumbling barrel for cleaning heavy castings has 800 Nelson ¾ in. dia. studs end welded to the liner plates.



A suspension uses air for its cushion

Air-filled rubber bellows bring new comfort to the coach passenger

A suspension system for transit-type buses has been designed by engineers at the Fort William plant of Canadian Car Company Limited. Known as "Air-Ride," it aims to give the best possible passenger ride and reduce to a minimum the service work necessary for maintenance.

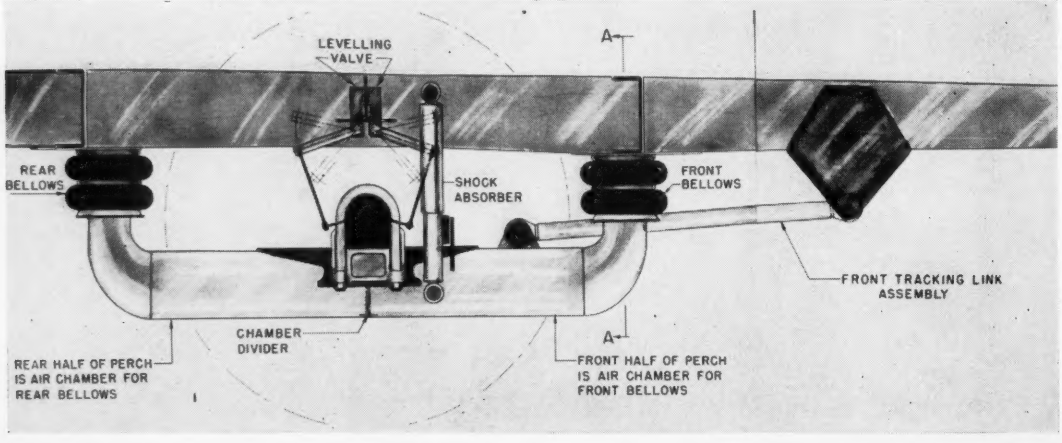
Eight rubber bellows (four front and four rear) connect the chassis to the suspension units. Perches, which also serve as air reservoirs, are bolted to the axles. The bellows are attached to each end of the perches and, by careful selection of the volumes of the bellows and perches, any desired ride conditions can be obtained.

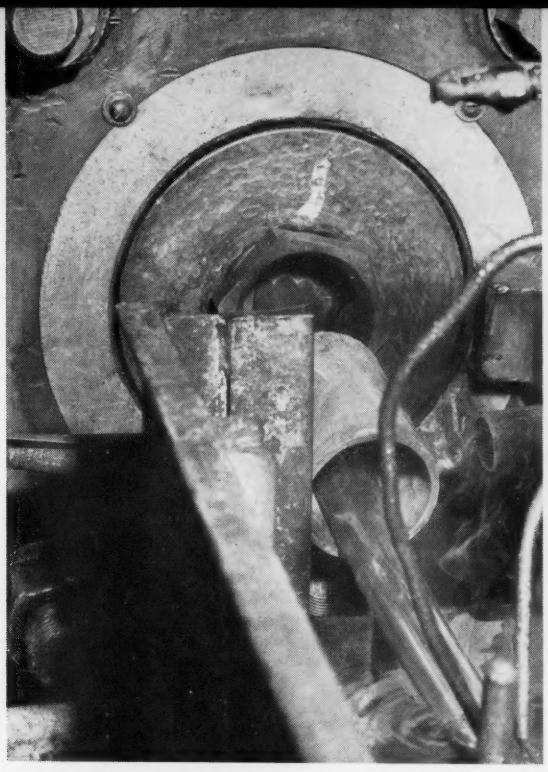
The suspension has attained a frequency rate of 85 cycles per minute. This provides an excellent ride and remains constant regardless of load. In comparison, steel spring suspension usually have a frequency of 100-110 cycles per minute: this varies as the load is increased or decreased.

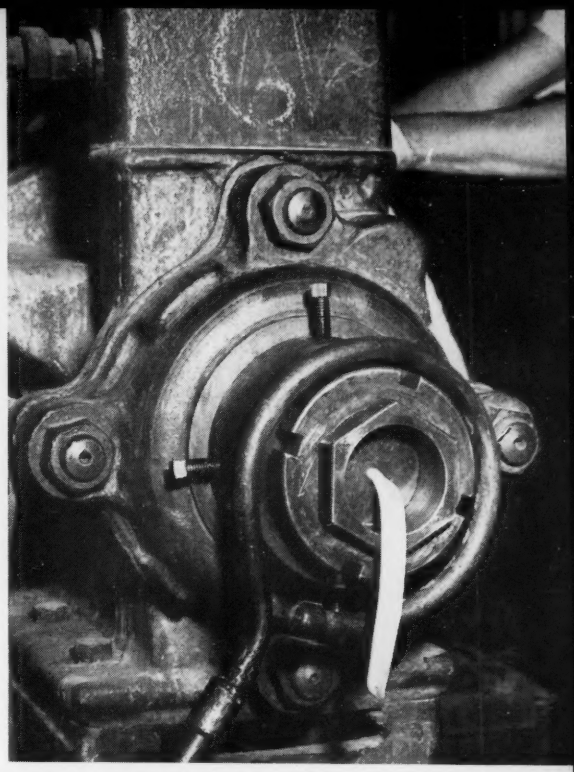
Since the perches provide separate fore and aft reservoirs, resistance to brake "wind-up" is achieved without the need for additional links. Only three links are used at the front and rear units, two to control fore-and-aft positioning and one for lateral positioning of the axles. The links are positioned so as to act as toggle arms and (through the principle of conflicting arcs) assist in wind-up resistance.

Three levelling valves (one front and two rear) automatically control the flow of air in and out of the suspension units to compensate for load variations. To reduce to a minimum the amount of additional air required for the suspension system, an automatic cut-out is provided. While the coach is in motion, the suspension system is isolated from the balance of the coach air system. The increase in compressor loadings due to the incorporation of air suspension is therefore only small.

All linkage attachments use bonded rubber bushings which, together with the rubber bellows, virtually eliminate the transmission of road noises to the interior of the coach. Linkages and center point steering designs are such that road shocks are dampened.







The extruded strip, upon leaving the die, is very plastic and is quickly cooled by being passed through water which contains soap or some similar ingredient to prevent the adjacent areas of the strip from sticking together.

Extrusion—a formula for success with all types of rubber and with plastics

The process can boast the utmost versatility. Success is to a large extent a result of ingenuity and skill shown by the expert diemaker

C. D. Jacobs B. F. GOODRICH CANADA LTD.

This article has been prepared principally for the guidance of designers, industrial engineers and others faced with the problem of designing or specifying natural rubber, plastic or synthetic rubber parts for industrial products and equipment.

The process of extruding is one of the oldest methods used in manufacturing rubber products. It can be used with equal success for producing items from natural rubber, synthetic rubber, plastic and reclaimed rubber.

For those totally unfamiliar with the process of extruding, it might best be compared with the principle involved in running meat through a food grinder. But prepared rubber, synthetic or plastic compound is forced by means of a spiral screw through a single (or a multiple) die. It is this die that determines the shape of the finished product.

There are several different types of extruding machine, but each uses the same principle of operation. Compounds can be fed into the machine by conveyor or by hand. The speed at which the machine runs de-

pends on the consistency of the compound to be extruded and the size of the die opening. Soft compounds are forced through more slowly than harder compounds, to prevent corrugations or waves in the extruded piece.

The machine is shaped very much like an ordinary food grinder but is many times larger. Dies are made of a high-grade steel plate and may be from ¼ in. to 1 in. thick. The services of skilled die makers are required to produce extruded parts which match customers precise specifications. Since the art of die making depends to a large degree on rubber swell during extrusion, and shrinkage during cure, only men who know rubber, plastics and synthetic rubber are able to produce dies that will form parts to close tolerance. Very few die openings are exactly the same size and shape as the parts they extrude. For example, a piece of rectangular cord made from a 45 durometer compound is extruded through a die that is actually scalloped in shape to compensate for the swell of the rubber after it leaves the die.

So swell, shrinkage and hardness of stock are vital factors to die makers and production men when they have a customer's blueprint to match. Those who are unfamiliar with the process often find it hard to understand why one die cannot be used to extrude parts of almost any hardness. Softer compounds have greater shrinkage and dies must be proportioned to allow for that. The same thing occurs when a different type of material is to be extruded. The same dies cannot be used for the production of extruded parts made of rubber, synthetic or plastics if close tolerances are to be maintained. Extruded sections with a maximum height or width of 2 in. are usually held to ±1/64 in. on production runs. Large sections are held to ±1/32 in., depending on the hardness of stock and the shape of the part being extruded. This inability to use the same die for all material is not a serious cost factor. It is general practice for the customer to assume die cost when the volume is low. If there is a good assurance that parts will be bought in large volume, the cost is quite often absorbed by the manufacturer.

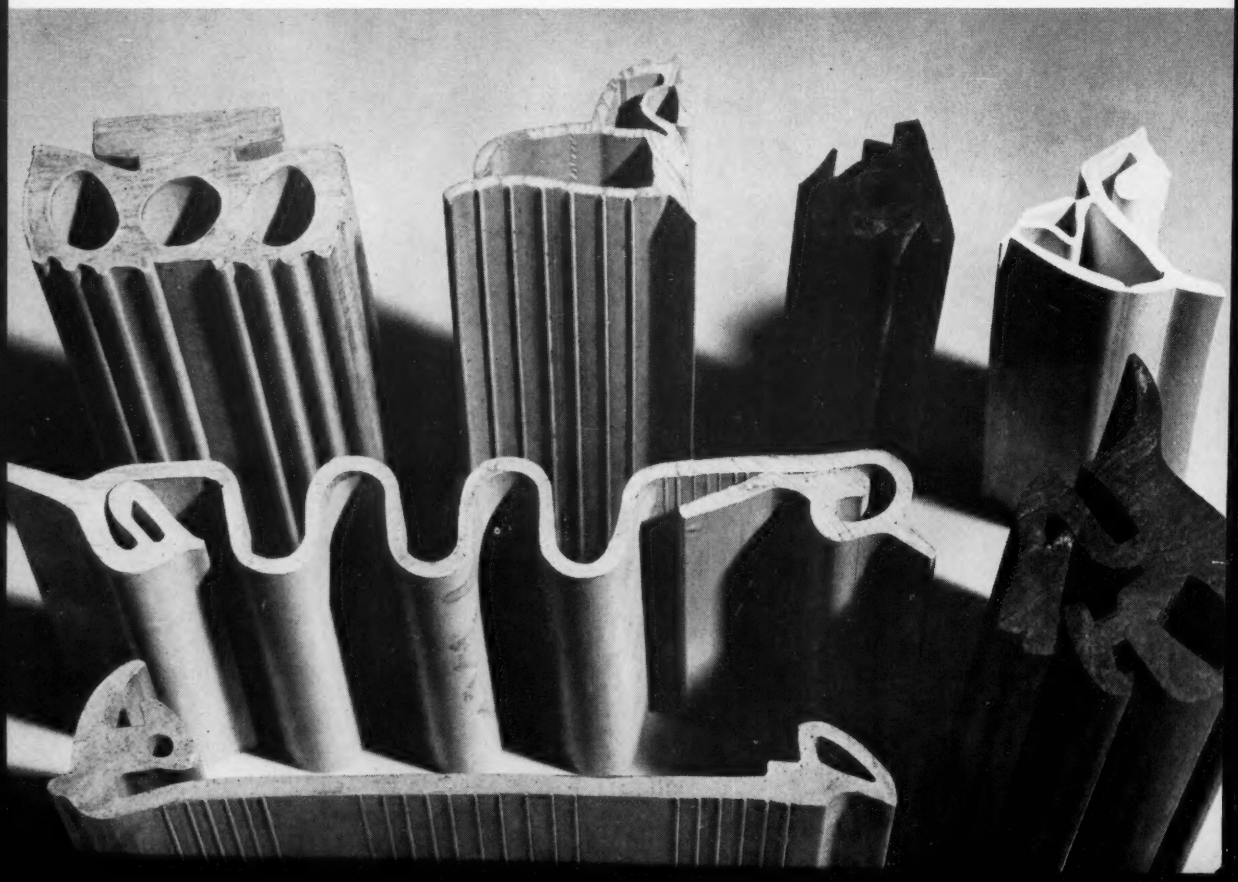
There are six steps in the manufacture of extruded parts:

- Compounding
- Milling
- Extruding
- Curing
- Inspecting
- Finished goods

All these steps are very important because each one plays an integral part in producing a quality extruded product.

Rubber, synthetic and plastic compounds for extruding are prepared in much the same manner as for any other rubber or plastic manufacturing process. The compounder's recipe varies, of course, with each different part that is to be produced, but a similar process of compounding is used in each case. Compounds are designed to meet optimum service life and to customers' requirements. In the case of rubber or synthetic rubber, age resisters, pigments, curing accelerators (and so on) are among the ingredients of most recipes. The proportions used depend upon the properties desired in the finished product. Just as a baker sifts his flour and measures his ingredients for an angel food cake with particular care, so do rubber compounders weigh and

The extrusion process makes possible the successful fabrication of many rubber products of intricate cross-section for use as engineering materials. This group of seven emphasizes the great versatility of the process.



The extruding die is seldom the same shape as the finished product and the diemaker has to allow for this.

measure every ingredient that must make up a satisfactory rubber compound.

Some extrusions demand a stock that is absolutely tasteless and odorless, whilst others must withstand the action of oils, grease or low temperature. Sometimes, a compound must be evolved to stand up under all these requirements, plus others that are even more exacting. Tasteless and odorless compounds are nearly always demanded by the refrigeration industry.

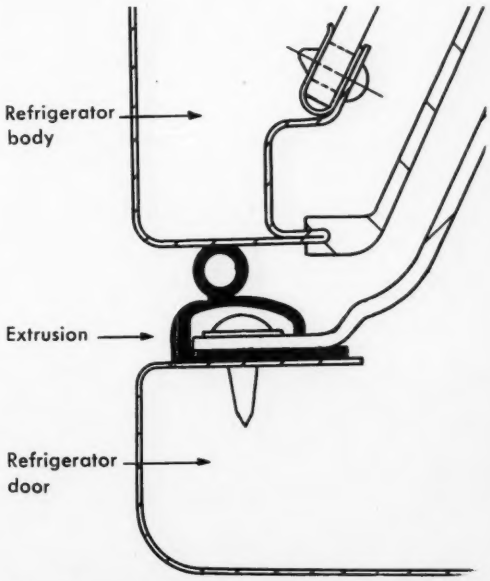
Rubber and plastic compounds intended for extrusions are not essentially different except to the extent that they affect die, shape and size. Extruded thermoplastic materials may be compared with crude American rubbers as follows: The ideal durometer hardness for plastics is 80+. Lowest easily extruded hardness for rubber compound is around 60. Minimum 45.

Below a hardness of 45, rubber extrusions must be supported on forms until vulcanized. Plastics are easier for matching colors than rubber. In larger sizes, plastic extrusions are not as flexible as those made of rubber. In smaller sizes, plastic compares favorably with rubber. Plastics have better tensile strength than reclaimed rubber extrusions. They are about equal to natural crude rubber in this respect. Plastics are easier to extrude in thin sections than rubber.

After the compounder has assembled all the ingredients necessary for the recipe, they are placed on a massive mixing mill (or Banburry, as it is called today) where they are masticated and thoroughly mixed together, just as a baker kneads his dough into a homogenous mixture. After careful mixing, the rubber compound is again put into a mixing machine and made into sheets: plastic is also made into sheets and then granulated. When these processes are completed they are ready for extrusion. After each compound is thoroughly mixed (and before it is released to the extruding department) a sample is sent to a factory laboratory, where tests are run for specific gravity, tensile strength, elongation and so forth to make sure that the finished extruded product will match the customers' specification in every respect. This safeguards against any imperfection in any of the batch ingredients. The mill compound is then fed into an extruding machine, from which emerges a continuous extruded shape that can either be cut to length or coiled round and round (if the shape of the part permits) on a circular plate before curing.

Conventional (and the easiest to make) extruded shapes are round, square, rectangular and hollow round (tubing). Complicated shapes must often be cut into lengths from 12 to 14 ft, laid straight and supported by curing forms which help retain the correct shape and support lifts or over-hanging edges which might otherwise cure in a distorted shape. Very often if the method of attaching an extruded strip is known when the job is first quoted, the part can be designed in such a way that it can be supplied in long lengths and not cut into short 12- or 14-ft lengths in order to be cured.

Some extruded parts are designed with a special lip which permits them to be clamped securely into place. Other parts are often produced with special wire (or wire mesh) insertions which also permit ease and security of attachment. It is also possible to extrude a piece of sponge rubber cord with a smooth coating of rubber on all sides. This type of gasket finds many applications and often replaces regular tubular gaskets because of its high compressibility and low permanent



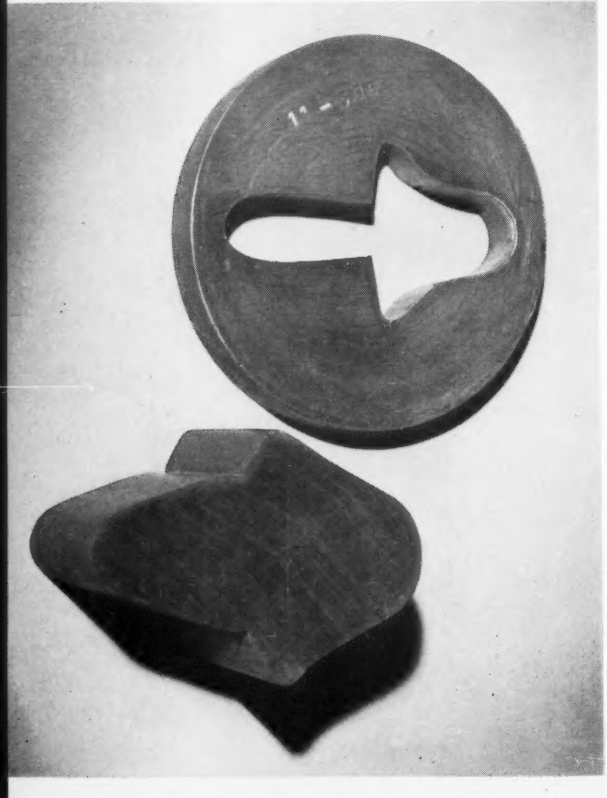
This section shows the sealing strip for a refrigerator door and looks at the seal from atop the unit.

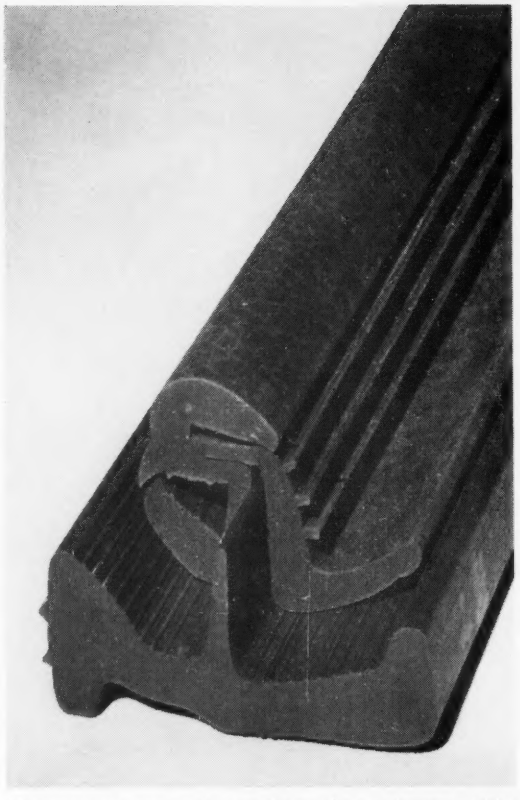
set. A very big piece of wire or thread can be embedded in the centre of the sponge core to prevent stretch and permit the extruded part to retain its exact length, even though it must be pulled taut during installation. As mentioned, the conventional shapes (round, square, rectangular and tube) do not require any particular manufacturing skill to produce.

A good point to consider is the flexibility of finished extruded materials. An important point for any engineer to consider is that there is a minimum of waste stock by the extruding process. Any defectively extruded or imperfect pieces can go right back into the extruding machine and be extruded again before they are actually vulcanized. Less waste stock means an ultimately lower cost to the customer.

The design engineer who believes that an extruded part will work into his new product because of its low cost, uniformity and other desirable features may save himself a lot of useless work (and his company considerable money) by consulting the technical staff of rubber manufacturers who produce extruded goods. Extrusion dies are not discarded after completion of the production run for which they were made. They are filed away and kept clean and free of rust ready for use again if they should be required. Manufacturers have thousands of such dies on file and the shapes they

The designer of an extruding die must take into consideration the swell and shrinkage of the compound. This point is graphically illustrated in this shot of a die bearing a small resemblance to the extrusion.





The process can take intricate shapes in its stride, witness these two molds which are designed to mate.

are capable of producing encompass just about every type that can be imagined, from simple tubes to complicated gaskets.

Often it is possible for an engineer to make slight alterations in his original design so that he can make use of an extruded shape that has already been produced and for which the die is on file. In this way, die cost can be eliminated and production can begin with a minimum of delay. The best time for the product designer to get in touch with the technical staff of a rubber manufacturer is at the beginning when the design is still in the early paper stage, and can therefore be changed rapidly. This is true of all other industrial rubber products, as well as extrusions. Even if the manufacturer has no standard extruded shape that will fill the requirement, he can often suggest changes that will lower the cost and make the extrusion do a better job. It sometimes happens that a product engineer will work out plans involving extruded parts and perhaps even may have stamping dies and other production equipment made before he consults experienced extrusion men. The problem then becomes one of developing an extrusion that will work with parts not designed for it, a problem sometimes extremely difficult to solve.

Minification

Recording gets caught up in a squeezeplay

The magnetic tape, which has an hour-long run, sits in its own separate magazine which is easily removed.

In the race to reduce, this recording machine is one of the winners

If the fathers of sound recording had been any hand at crystal-gazing they would have shown a justifiable incredulity of the lengths to which minification has been carried in today's equipment.

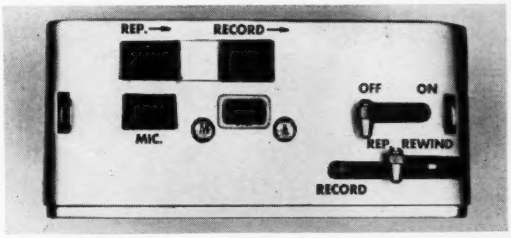
In an era when a dime-size battery can power a watch for more than a year, we still find cause for raised eyebrows in a tape recorder as small as the Dictet. This midget, which measures only 2 in. x 4½ in. x 6 5/16 in. (about the size of a 35mm camera without protruding lens) and tips the scale at an even 2 lb 11 oz, is a masterpiece in reduction made by the Dictaphone Corp.

Applications in the field of on-the-spot reporting suggest themselves immediately, but anyone who uses dictating equipment and operates it at any other place than an office desk can see the very real advantages in such compactness and portability.

Recording time is 60 min and the magnesium case houses the batteries, motor, tape reels, recorder-reproducer head, erase head and transistor amplifier. The motor gets its life from two 6-volt mercury batteries which have a 20 hr life. The amplifier battery, also 6-volt, has a 40 hr life expectancy.

The microphone (which is not a part of the case) is a magnetic type and does double duty as the playback speaker. To save battery power, Dictaphone has arranged the Dictet's circuits so that the motor only runs when the mike is connected. As a further safety measure, the erase head does its job ahead of a new recording and only with the control knob at "record."

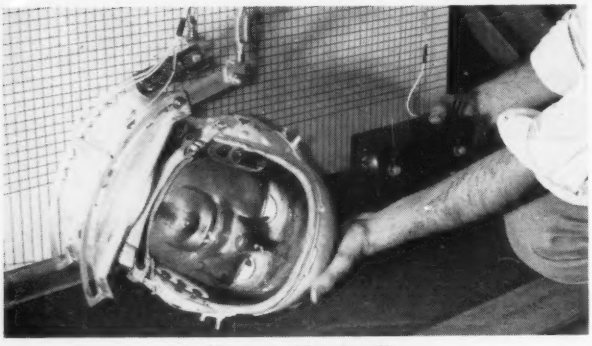
The magnetic tape, ¼ in. wide and 400 ft long, travels at 2½ in./sec when recording or replaying. A power rewind will spin it back onto its first spool in 2½ minutes. The baseplate is of stainless steel and the amplifier uses a printed circuit with four transistors. ★



The fingertip controls are all at one end of the case.

The Dictet's microphone doubles as playback speaker.

Design news in pictures

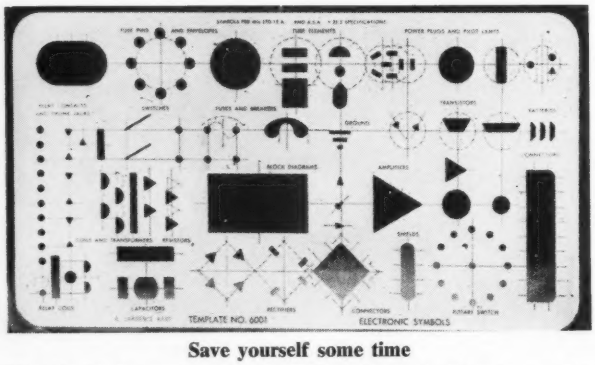


Oh my aching head!

This aluminum head has been used to test new types of pilots' helmets at North American Aviation. The impacter held at the right is swung in measured arcs and the force of the blows is recorded electrically through pickups inside the helmet. (200)

Come for a dip

An eight-year-old gets the feel of the family swimming pool. This one, of Celanese plastic reinforced with glass fibres to add strength, is assembled on the purchaser's property. (203)

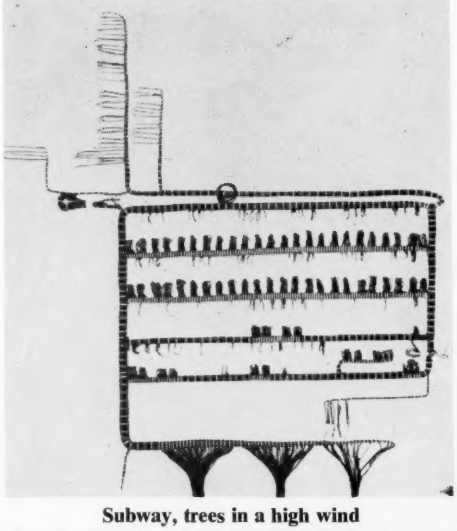


Save yourself some time

Vinylite finds another use in this schematic diagrammer for electronic circuitry work. The sharply engraved symbols it offers include PNP and NPN transistors, diodes, electronic tubes, power plugs, pilot lamps, relays and resistors. (201)

Spindle for an 81-ft turbine

Westinghouse is developing and building a nuclear reactor for the U. S. Atomic Commission in Lester, Pa. This enormous spindle is a part of it. When assembled, the 100,000 kw steam generator will handle 1,400,000 pounds of steam per hr. (202)



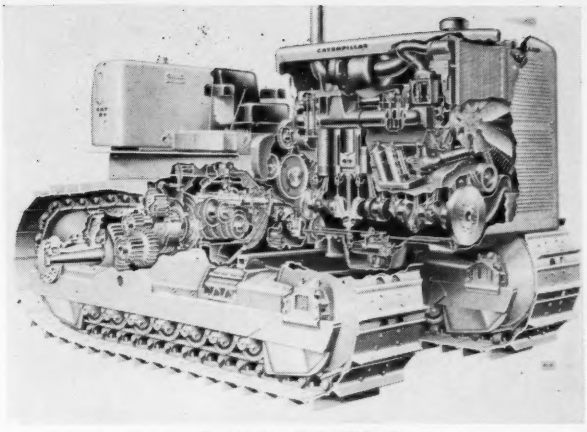
Subway, trees in a high wind

A newsletter from R. H. Nichols Ltd. told us of the good work they do on wiring jobs. We particularly liked this control panel cable which aped the impressionist's subway station. (204)

Some modern designs making news today

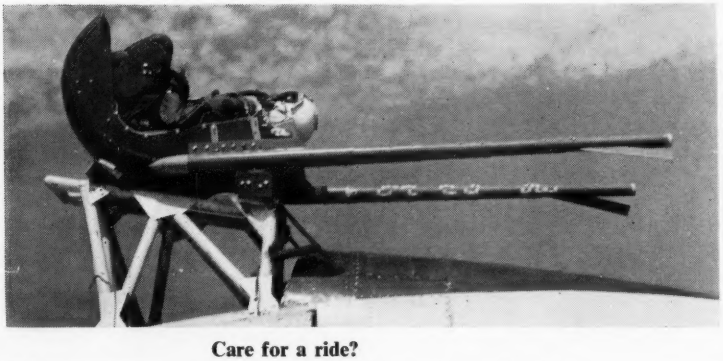
It's a trap

No part of the core of an atomic reactor — it's a lint filter for Maytag's drying machine. The trap revolves as it filters air. (205)



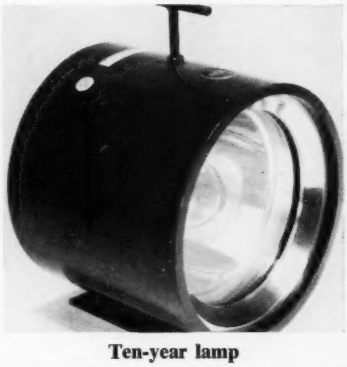
Anatomy of the "Cat"

The moving of mountains used to fall into the "miracle" class once upon a time. This Caterpillar tractor makes it a reality. With 320 hp from its supercharged diesel engine, it can heave a mighty thirty tons of drawbar pull into the collar. (208)



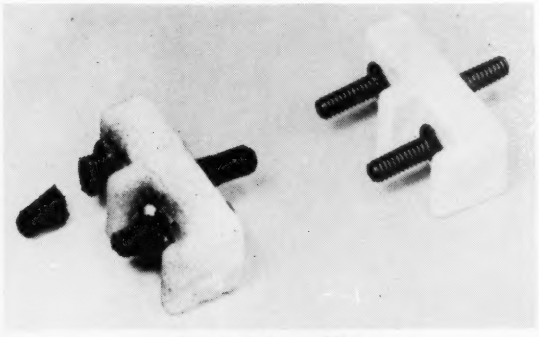
Care for a ride?

Poised on a supersonic sled, an ejection seat is ready for a fast run. It projects the dummy feet first into the windstream and the twin booms behind the seatback stabilize its flight in much the same way as a stick on a skyrocket. (206)



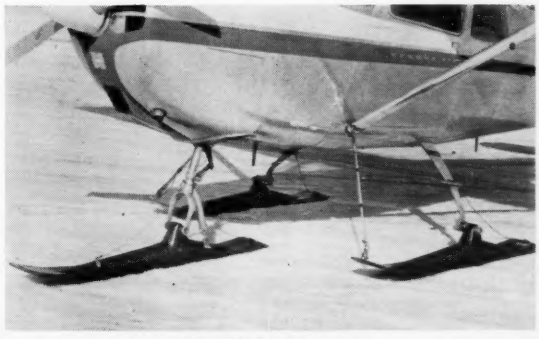
Ten-year lamp

This radioisotope-excited lamp will provide marking illumination for up to ten years or more with no power or maintenance required at all. (209)



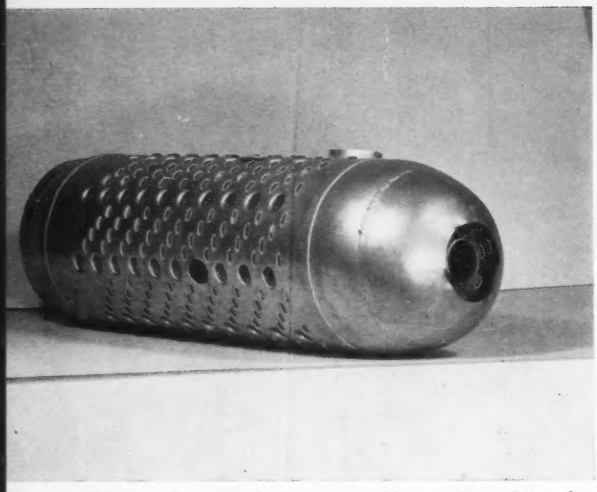
Proof of the pudding

Failure of the control mechanism in a laboratory furnace resulted in this ceramoplastic terminal block being subjected to 1,600 F for 24 hr. The steel inserts were almost burned away while the block had retained its shape. (207)

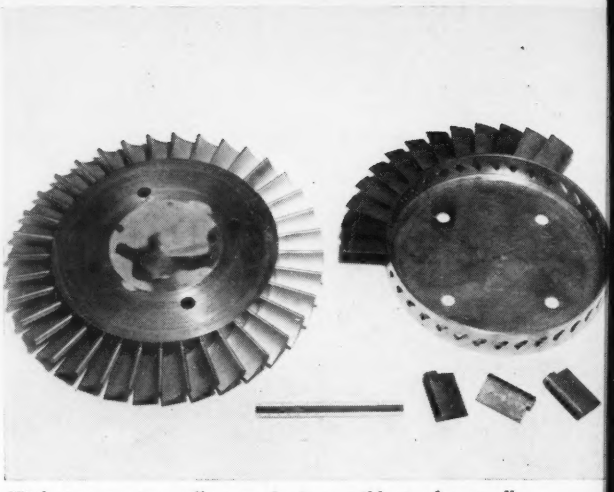


Aircraft in the snow

These skis for light aircraft, reputedly the first to be constructed entirely of fibreglass-reinforced polyester, are manufactured in Anchorage, Alaska. The skis are said to have exceptional deep snow performance. (210)



This combustion chamber assembly was brazed in a hydrogen atmosphere furnace with the Nicrobraz alloy.



High temperature alloy made it possible to braze all these stainless steel blades to the hub at one time.

Brazing

Alloy for good brazing with stainless

Brazing the stainless steels calls for special skills and a brazing alloy that can match closely the characteristics of the parent metal

These samples, which were done at the company's plant in Detroit, are starter assemblies for jet engines.

A complex automotive assembly which was brazed with Nicrobraz throughout. Note part's bright appearance.

Special skill is required in the processing of stainless steel. What is more, the methods used must be up-to-date, for they are a basic part of the fastest changing segment of today's technology: jet and atomic age metallurgy.

The Stainless Processing Division of Wall Colmonoy Corp., has all the necessary facilities for stainless steel processing and brazing work. In addition, they have developed (and manufacture) the Nicrobraz line of high temperature brazing alloys.

These alloys have tremendous heat and corrosion resistant qualities and are used for joining stainless

The different alloys in the range provide a variety of qualities to meet specific needs. Some have low melting points whilst others have low carbon content and greater ductility. The alloys are usually supplied as a fine powder but may also be had as oxy-acetylene rod, plastic bonded shim stock and wire, prefabricated rings for tube assemblies, flux and powder blended to a paste and as a special powder for spraywelding.

In the test results shown in figs. 1 to 4, the standard alloy was used. With it S 590 stainless steel specimens were furnace brazed in pure dry-hydrogen, giving optimum strength and high temperature properties. As shown in fig. 1 a Nicrobraz joint has a tensile strength equal to that of the parent metal up to a temperature of 2,000 F. It is resistant to most chemicals and retains its physical properties under oxidizing conditions. It begins to melt at 1,760 F and flows at 1,950 F in a pure dry-hydrogen atmosphere. The alloy formed at the joint after brazing has a remelt temperature of approximately 2,400 F.

With furnaces capable to receiving workpieces up to 72 in. high x 70 in. diameter, stainless steel and special allow parts can be brazed using Nicrobraz, copper or silver brazing alloys. They can also be bright annealed, bright hardened and stress relieved. All this work is done in a pure dry-hydrogen atmosphere with dew points of—80 to—100F. The parts come out clean and bright with virtually no distortion, scale or oxidation.

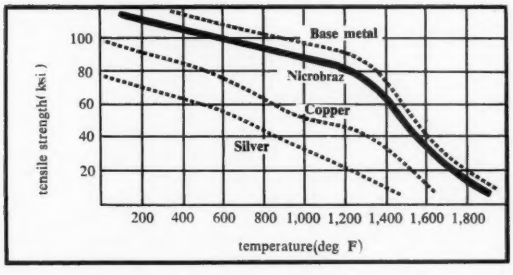


Fig. 1. Tensile strength of a Nicrobraz joint closely parallels that of the base metal at temperatures up to 2000F. Copper and silver brazings are much weaker.

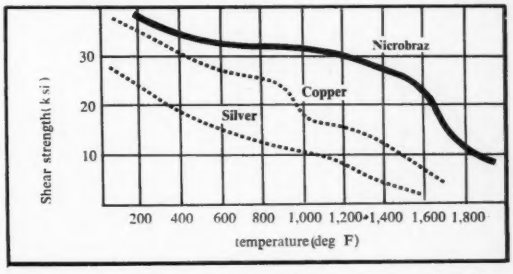


Fig. 2. A comparison of Nicrobraz, copper and a high-temperature silver brazing alloy. The added strength offered by the former is easily seen in this graph.

In the test results shown here, the standard brazing alloy was used

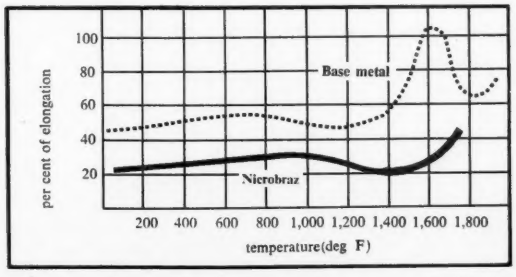


Fig. 3. This graph shows the percentage of elongation at temperatures up to 2000F of Nicrobraz and the base metal (S-590) which was used during these tests.

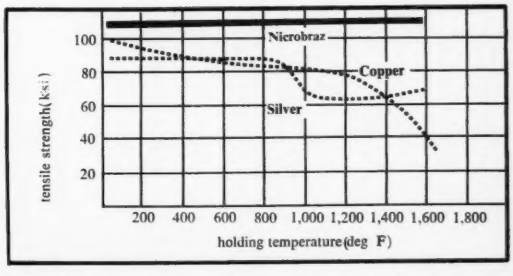


Fig. 4. Loss in strength of copper, silver manganese and Nicrobraz joints after 50 hr aging in air at various temperatures. Joint of Nicrobraz was unaffected.

Ideas round-up

Mounting pads: you can cut them yourself

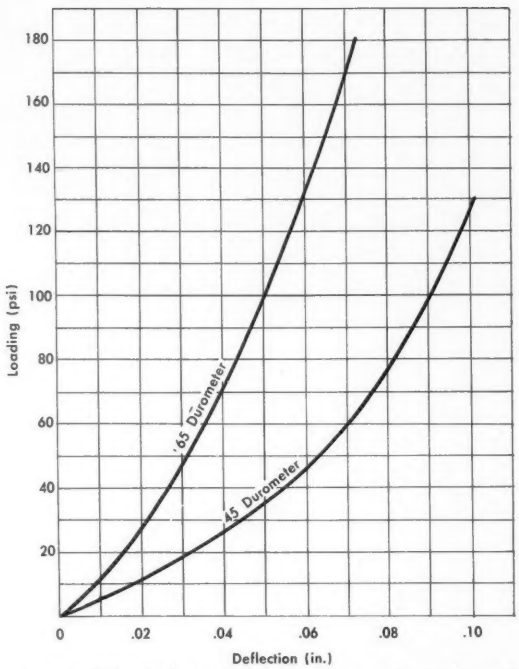
Mounting of machines on Isomode pads eliminates the need for built-up bases and also hold-down bolts in a great many installations. So whether you want to locate or relocate equipment, you can do it with minimum expense, in less time, and with no unsightly marring of plant floors. Because of its resilience, the pad not only helps correct the effect of mismatched assemblies, but it also absorbs the undesirable frame and floor stresses generally present during operation of rigidly attached machines.

Engineered an fabricated by **MB Manufacturing Co.** from du Pont neoprene, the pads not only have the resilience for unusually effective vibration absorption, but also resistance to "set" and to deterioration from moisture, oil and cleaning compounds. Service records for the past 5 years show that they have maintained their vibration absorbing efficiency in the face of severe operating conditions and are still in excellent condition and giving satisfactory service.

Though Isomode Pads are only 5/16 in. thick, the 18 x 18 in. size alone (in the recommended range of loadings of from 10 to 50 psi) can support and isolate 1½ to 8½ tons of machine! Even heavy punch presses are effectively isolated with just the single thickness, so that many machines restricted to heavy ground floor installations can be located on any floor!

With hands, shears, or a knife, the pads can be cut to the required size and shape from standard pads, right on the spot. No close fittings and no waste, since any excess can be used for other installations.

When there are small or no external lateral loads, a plain mounting as shown in Fig. 1 (a), with or without cementing, is a very practical installation (special cement is available). "Walking" is eliminated on most types of machinery without the expense of tie downs, hold downs or lag screws. Bolted supports are isolated, as in Fig. 1(b), and overhead supports as in Fig. 1(c). A short piece of plain rubber tubing is inserted on the bolt or lag screw to prevent "bridging" of vibration. (211)



A typical load deflection curve for an Isomode pad.

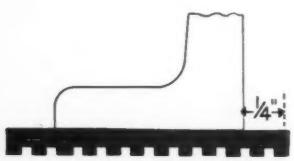


Fig. 1(a)

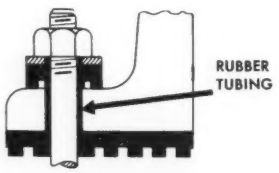


Fig. 1(b)

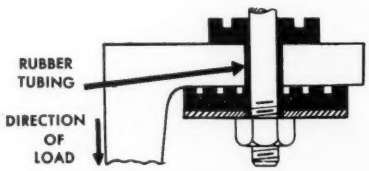


Fig. 1(c)

Release hook: it developed for the helicopter

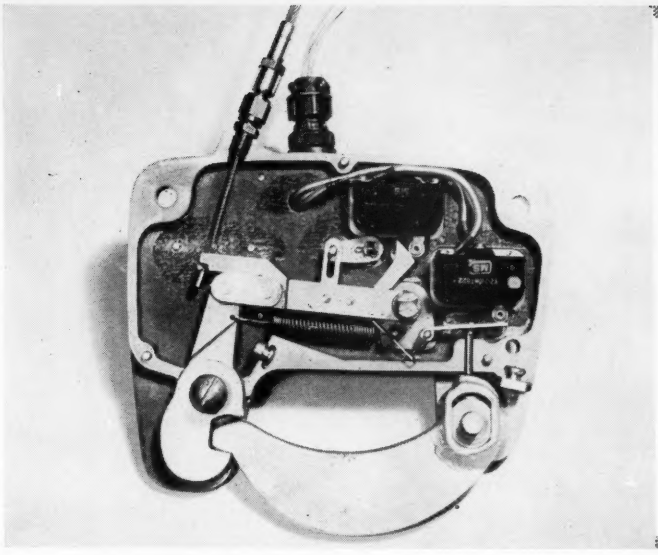
A line of lightweight cargo release hooks (that can release loads automatically) has been developed by Eastern Rotorcraft Corp. The hooks can handle cargoes weighing up to 25,000 lb.

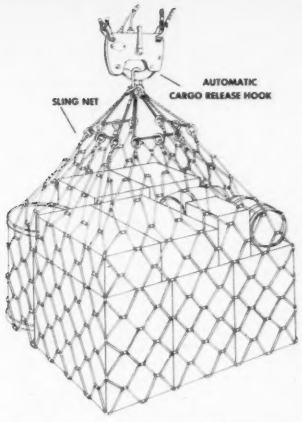
Originally designed for use by helicopters in transporting suspended cargoes, they could quite well be used in general cargo and materials handling operations.

Simplicity of design and operation enables the hooks to be released in four different ways: (1) electrically by the operator; (2) mechanically by the operator: (3) mechanically by ground personnel; and (4) automatically by touchdown of cargo.

The housing of the release hook is a high-strength aluminum casting. It has two mounting shackles for attachment to the crane or other carrying device. Load beams and latch mechanisms are of high strength steel.

Completely enclosed and weather resistant, the units are electrically triggered by a rotary solenoid. This type





Left: The releasing mechanism.
Above: Holding the loaded net.

of solenoid simplifies sealing of the housing and permits a compact arrangement of moving parts.

Electrical current for automatic touch-down operation is controlled by a master circuit in the pilot's compartment and may be turned off during cargo transportation to eliminate any possible pre-release of the load. A limit switch in the hook body controls the circuit and a spring loaded plunger in the trunnion keeps the switch open while loads are being carried.

Five different models of the ERC cargo release hook are available from Model A-25, rated at 2,500 lb to Model A-250 rated at 25,000 lb. (212)

The swivel castor: it may be obsolete

Is the familiar swivel castor to be considered as the last word in design and efficiency? The present suggestion from reader Nydegger might well prove the contrary!

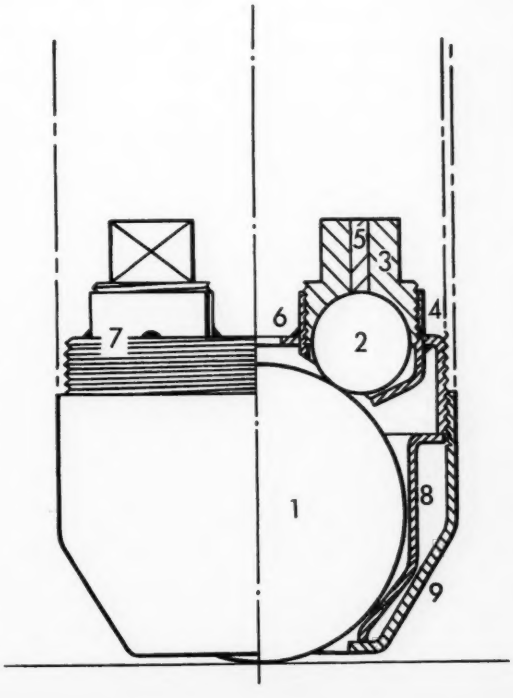
Development in plastic materials makes it possible to envisage the combining of the horizontal-trailing and the vertical pivoting movements of the swivel castor into one all-around movement as in the "cushion roller."

The design of this new device calls for a simpler and more compact construction, encasing a resilient plastic cushion ball. The efficiency would be in direct ratio to the chemical make-up of the ball.

The resilient plastic cushion ball (1) would be long wearing, easy-rolling and shock absorbing to encompass combined horizontal-trailing and vertical-pivoting movements. An outer sheathing of the ball (of extra tough plastic composition or metal-base application) would ensure efficiency during prolonged stationary periods. Inherent adhesive properties would prevent or reduce displacement tendencies due to outside vibration. No lubrication would be necessary here, since the transmission is by means of steel balls (2) rolling in separate adjustable bearings (3) and retaining tubes (4). Solid composition plugs (5) would provide permanent self-lubrication. Crown assembly (6, 7, 2, 3, 4) constitutes the stock element attached to the vehicle, while the inner spacer shell (8) and outer screw-on shell (9) complete the device.

Supplementary parts (not shown) such as the lower ball-race, jack and brake could be built in without any special difficulty. (213)

Continued on page 72



Dust collection: it has to move fast to be caught

A new device for dust collecting has been introduced by Joy Manufacturing Company.

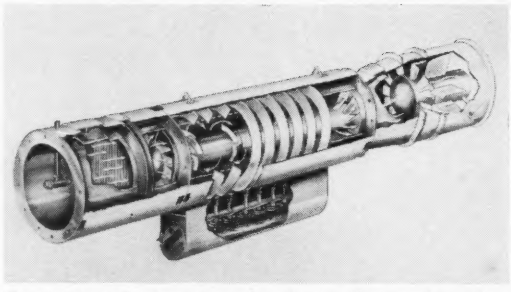
Called the Microdyne dust collector, the new unit is a wet, inertial type claimed to have an efficiency greater than any comparable wet type collector. Test figures show an efficiency of 99% in collecting dust particles of five microns or greater, a micron being equal to 1/25,000 in.

The new dust collector is the first commercial outfit embodying all the fundamental principles of the Greenberg-Smith Impinger, long used as the standard dust measuring instrument by the U. S. Public Health Service.

Real impingement only occurs when dust and its carrying air impinge at high speed (4,500-6,000 lineal fpm against a film of water. This happens in the mixer section of the Microdyne.

It is a cylindrical device having two essential parts; a mixer section and an eliminator section. The dust-laden air (or gas) enters the unit at its mixer section. Here the impingement takes place. Each dust particle is enveloped in water as it passes through a fine spray.

The air and entrained water-enveloped dust pass through turning vanes as they enter the eliminator section. These vanes impart a helical motion which causes a centrifugal force which dynamically separates the entrained particles from the air. The dust-laden water is captured at the periphery of the eliminator section in blind louvres which are connected to a disposal sump at the bottom of the unit.



Contaminated air enters the dust collector through a mixing section with a spray and impingement element.

The clean air passes out of the eliminator section through straightening vanes which recover the energy of rotation and thus reduce the over-all draft loss.

If sufficient pressure to drive the gases is not available ahead, a fan may be attached to the rear of the unit.

The dust collector can be mounted in existing duct work at the point of use. (214)

Air-powered grinder: an all-round tool

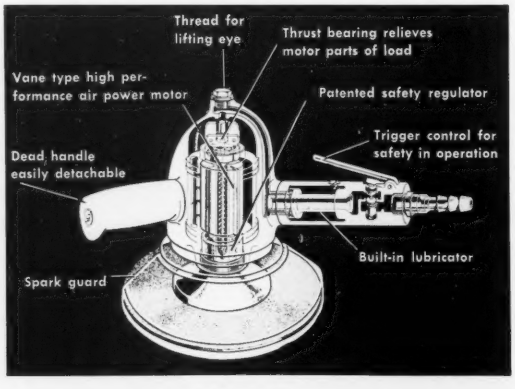
The high productive potential of the recent amazing developments in abrasives, giving cutting speeds as high as 250 fps, are brought out by the Atlas LSS 81 air-powered grinder. The combined features of this new tool (and the nylon-reinforced hub wheel) open up for portable hand grinders a wide field of application hitherto restricted to stationary machine tools or even altogether outside the scope of grinding.

The LSS 81 grinder with reinforced hub wheel offers, moreover, the advantage of enabling a large number of operations to be performed simultaneously or in rapid succession without changing the wheel. In the fettling of castings, for example, feedheads and gates can be cut off with the edge of the wheel, while mould marks and other roughnesses are smoothed off with the face.

A steel pipe can be cut off in a matter of seconds.

Much higher speeds and greater power than were formerly available in portable hand-held grinders are required for reinforced hub wheels. With the development of the LSS 81, grinding shop operators have at their disposal the means of using to the full the potentialities of these wheels.

The grinder is a fast, powerful, high-performance machine which will drive a 9-in. reinforced hub wheel at 6,000 rpm developing a power of 2.4 hp. To prevent operator fatigue, it is light in weight and exquisitely balanced. Safety governor, trigger handle and spark guard ensure risk-free operation.


Thread for lifting eye
Thrust bearing relieves motor parts of load
Vane type high performance air power motor
Patented safety regulator
Trigger control for safety in operation
Dead handle easily detachable
Built-in lubricator
Spark guard

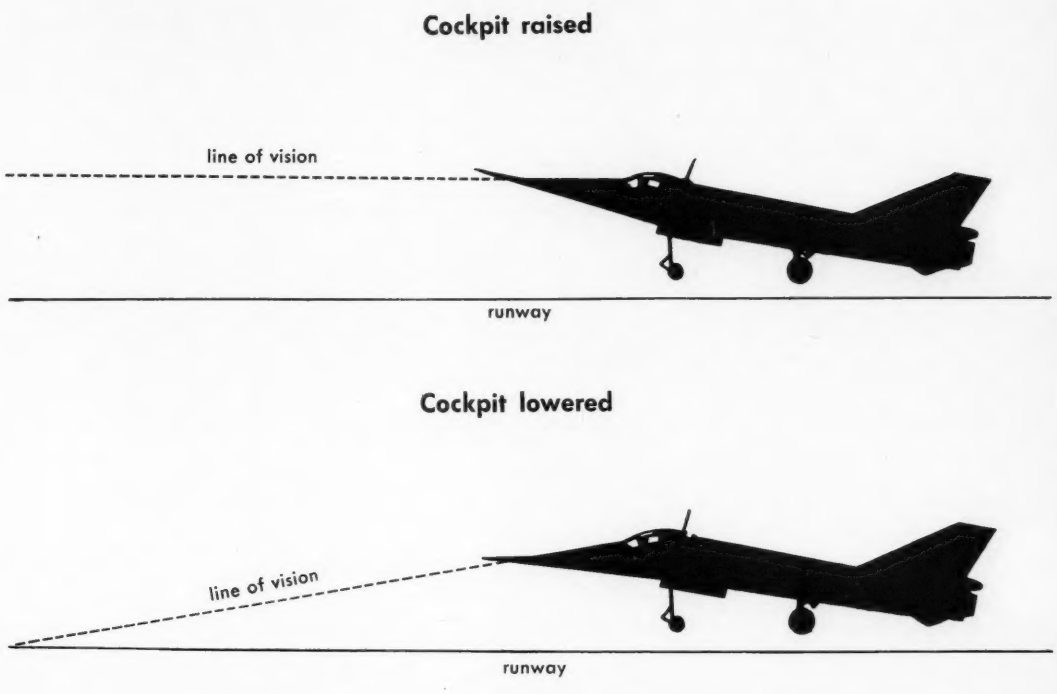
It can be used for cutting off and notching feedheads and for dressing castings. Brass, bronze and aluminum can, in addition, be cut and ground.

Hand grinding with the LSS 81 replaces chipping and machine cutting of bevel joints before welding—dressing of welds—wire brush cleaning.

It replaces the hacksaw for cutting off steel and copper pipes. It is also useful for removing surface cracks on billets prior to rolling and for finishing large dies. (215)

Continued on page 73

Drooping the nose: on the Fairey Delta 2



With the need to keep the height of the windscreen to a minimum and yet give the pilot adequate view at the high angles of incidence at landing, various schemes (such as retractable seats and so on) were studied on the Fairey Delta 2. The final (and the simplest) solution was that of drooping the nose of the pressure cabin.

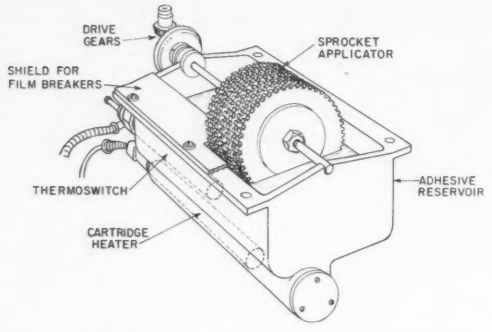
This is hinged on the bottom longerons and is operated by a hydraulic jack. It is a light and straightforward means of giving the pilot better view and has been reliable in operation. It did, however, set up some problems connected with the jettisoning of the hood. To ensure that the hood would jettison correctly, it was desired that it should pivot about an aft hinge on release. This pivot point, however, could not be earthed on the fuselage, due to the drooping of the nose including the hood. This was overcome by having two "Barrow handles" carrying the aft pivot points, tipping with the droop nose and lying flush in troughs in the main fuselage in the nose-up position. To keep the drag to a minimum, the hood was designed with very small clearance from the pilot's head and is kept flush with the surrounding structure by having hinges on one side, thus avoiding sliding mechanisms which would increase the difficulties of pressure sealing. (216)

Adhesive coater: for applying liquid phenolic

Preheating a liquid adhesive before application has solved the problem of nonuniform coatings and has eliminated waste, run-off and time-consuming clean-up in a coating machine manufactured by Permafuse Corporation. The purpose of the coater is to apply liquid phenolic adhesive to brake linings for subsequent bonding to brake shoes in a curing oven. The adhesive is applied to the arc-shaped brake lining by a powered transfer roller which rotates through an adhesive-filled trough.

Originally, the coater was designed to operate at room temperature and the adhesive was formulated to have the proper viscosity characteristics at about 75 F. In most service shops, however, it was rarely possible to obtain consistent viscosity, because room temperature might vary by 20 deg during the day and by 50 deg or more between seasons. This led to application difficulties. When the viscosity was low, too little adhesive was picked up by the transfer roller. When cold room temperatures raised the viscosity excessively, the roller applied too much adhesive, which was not only wasteful but also created a troublesome clean-up job when the excess was squeezed out during the bonding process. Even at "normal" temperatures there were problems. During the few minutes it took for the solvent to evaporate after the adhesive was applied, the adhesive

Continued on page 74



The redesigned adhesive reservoir shown in detail.

tended to creep down the surface of the arc-shaped lining and too little on the higher points, so that it was difficult to get uniform bonding.

Permafuse solved these problems with several interdependent steps. The first step (designed to assure uniform viscosity, and hence coating thickness, under all conditions) was to preheat the adhesive to 115 F before application.

Next, the adhesive reservoir had to be redesigned so that the adhesive could be heated safely and efficiently. The new reservoir is an aluminum casting with a longitudinal hole cored in the base to receive a 325-watt, 3-amp cartride heater.

The adhesive applicator, designed specifically for semiviscous liquids, is made up of a series of fine sprockets mounted about 3/16 in. apart on a common shaft. The spaced sprockets apply the adhesive in a row of parallel strips, which fuse together into a continuous full-width coating during the bonding. Thus, much of the flow is inward and squeeze-out around the edges is eliminated.

The problem of preventing the adhesive from seeping down between the individual sprockets is solved in an ingenious fashion by the use of film breakers between each sprocket. These are straight rods crimped loosely around the shaft and extending radially about ¼ in. beyond the sprocket teeth. As the roll rotates, the film breakers are held stationary by a shoulder on the edge of the reservoir. In this position they wipe the adhesive from between the sprockets as they rise out of the reservoir and return the excess to the reservoir. (217)

Stressed panel fastener: it locks positively

A patented quick-action, stressed-panel fastener that will withstand high shear and tensile loads, lock positively in less than one-half torque-free turn and compensate automatically for sheet separation resulting from warpage or deformation in the panels being secured has been developed by Waldes Kohinoor, Inc. (They manufacture Truarc retaining rings, grooving tools and other products.)

Known as the Waldes QAF, the device is intended for use on structural load-carrying panels in aircraft, guided missiles and other applications where quick access to service areas is required.

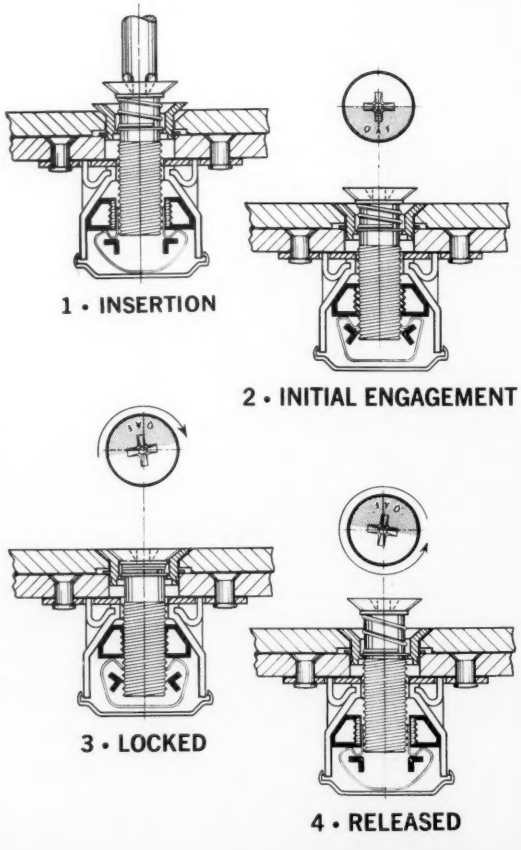
The fastener exceeds the strength specifications of National Aircraft Standard (NAS) No. 547 and, according to Waldes engineers, conforms to the airframe industry's so-called "idiot-proof" operating requirements.

The QAF has two major components: a retained stud assembly and a receptacle assembly. The stud assembly (available in flush or protruding-head types) is held in the panel by a retaining ring. The receptacle assembly is riveted to the air frame.

The fastener is engaged simply by pushing the stud (a high lead screw with a deep No. 2 Phillips recess) into the receptacle by hand or with a screw driver. An audible "click" indicates that the stud has been secured in a split nut in the receptacle and that the panels being fastened are held in place loosely.

The split nut moves in a tapered housing. As the screw is turned, the nut is wedged into the narrower part of the housing until it is locked in place.

To disengage the stud and receptacle the procedure is reversed: the preload is released so that the stud is loose but still engaged. The screw is then disengaged from the nut, after which it is ejected automatically from the receptable. Disengagement is accomplished in less than one full turn. (218)



Continued on page 94

Drafting efficiency

Continued from page 55

It was found that the energy consumed by the person who maintains a stooping position is 40% to 50% greater than that consumed in a normal standing position. The increased use of back muscles to maintain a convenient working position accounted for much of this increase and is undoubtedly responsible for the much higher incidence of backaches. Foot complaints must be expected from draftsmen who stand to their work.

When the French Ministry of Education appointed a committee to investigate the causes of absenteeism in government departments their report (the results of which were published in "Annales d'Hygiene") stated that working at the horizontal board "inevitably results in deformation of bone structure and in most cases results in painful disturbances of the digestive organs. Compression of the thorax (when stooping or leaning over a board) can also cause considerable functional complaints in the respiratory organs, since sound respiration is inhibited and vital capacity reduced."

Equipment that permits almost ideal working conditions for draftsmen is of course available in the modern drafting machine and drawing stands that are adjustable at a finger pressure.

How many of these men are getting a fair break and being allowed to do their best work? ★

No time like the present

LOTS OF YOU ENGINEERS have the nucleus of an article tucked away in a drawer somewhere, either in the form of rough notes or as a rough typescript.

The reason, of course, that you haven't done anything about it is because you probably feel that nobody will be interested in publishing it—so why do all the work necessary to get it in shape for nothing?

There is somebody interested in your technical article: DESIGN ENGINEERING is always on the lookout for suitable contributions. Not that we are short of material, mind you. But it does seem a pity that good stuff should not see the light of day.

Why not act at once and tidy up that article, get it typed and submit it to DESIGN ENGINEERING? If we like it enough to publish it, you will be paid. Not a fortune, perhaps, but enough to make it worth your while.

And think of the personal satisfaction of seeing yourself in print.

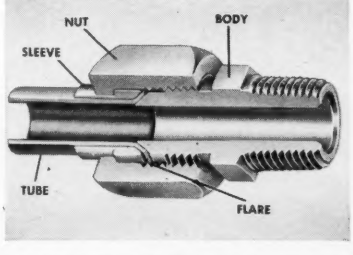
New Parker No-Skive Hoze-lok

FASTER . . . EASIER . . . RE-USABLE

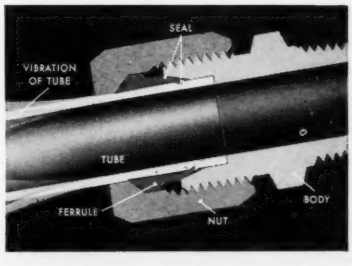
No more frustrating jobs of stripping covers from hydraulic wire-braid, rubber-covered hose! No more ragged hose ends refusing to enter sockets!

New Parker Hoze-lok Fittings save you all this time and trouble. Skiving of hose covers is *not* necessary. Simply screw the nipple in to complete the make-up. What could be easier . . . or more effective?

Versatile Hoze-lok Fittings are reusable . . . an important benefit to users of your equipment. Select your Hoze-lok Fittings now from the new, wide range of styles and sizes, with four different connecting ends and full range of adapters. Send for Catalogs 4433, 4434.



Triple-lok Flare Fittings . . . the easiest, fastest, safest way to tube up even in close quarters. Leakproof even under severe vibration, high pressures. Meet S.A.E. Standard. Catalog No. 4310.



Ferulok Flareless Fittings for high-pressure heavy-wall tubing. Double seal makes Ferulok leakproof, vibration-proof. You can see the "bite." Meet S.A.E. Flareless Standard. Catalog No. 4320.

TUBE AND HOSE FITTINGS DIVISION
Section 431-K
The Parker Appliance Co.
17325 Euclid Avenue
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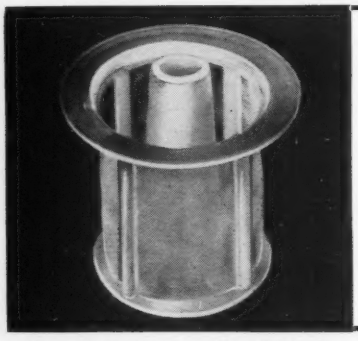
Parker
Hydraulic and fluid system components

New products & materials

Filters
All-nylon filters designed to withstand rust and corrosion in a wide range of applications have been announced by **The Danielson Manufacturing Company.**

These Danco filters are custom-molded in types, sizes and shapes to meet specific filtering requirements. One-piece nylon moldings, with a nylon mesh and supporting structural frame (injection-welded together in a permanent bond) offer greater savings in original cost as well as in production assembly, according to the manufacturer.

Nylon screen filters are effective in the filtration of lube, diesel and hydraulic oils, water, gasoline, insecticides, cutting oils, air and other applications. (219)



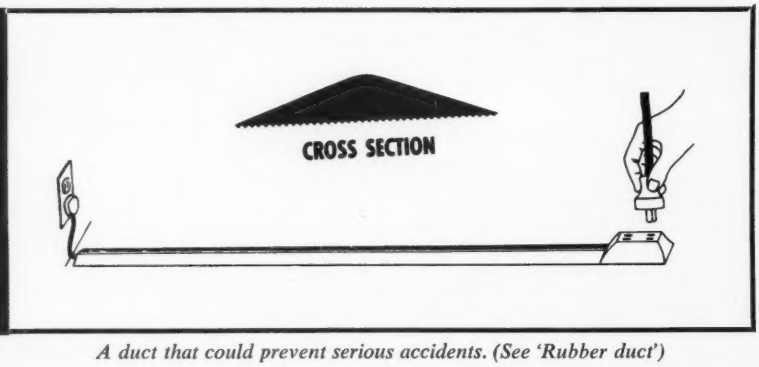
One piece of nylon. (See 'Filters')

Rotary joint
A new freeproof rotary joint that gives unusually long service life on rotating cylinders (such as are used on dryers, mills or presses) is the **Phillips** Exacto. This unit is the first of its kind to guarantee to eliminate "seizing or freezing on the roll". The standard unit operates efficiently at steam pressures up to 250 psi, with temperatures up to 500F and speeds up to 1,000 rpm.

Other unusual features include flexible shaft alignment for easy installation, packless and self-lubricating bearing surfaces, with a new low minimum turning torque. The internal pressure relief design also allows the sealing members to function independently of the load. (220)

Rubber duct
A noiseless rubber duct (called Electriduct) was designed to eliminate serious accidents caused by tripping on electrical wiring, small hoses or metal tubing lying on top of the floor. It is suitable for laboratories, workshops, factories, offices and so on.

The duct is available (from **Ideas Inc.**) in two forms. One is a complete electrical extension cord (wired for heavy duty) with a wall plug and cord on one end and a duplex outlet on the other. This is available in various lengths. In the other form, ducts, outlets and fittings are available separately for special outlet arrangements, as well as for covering cables, wires, small hoses or tubing. (221)



A duct that could prevent serious accidents. (See 'Rubber duct')

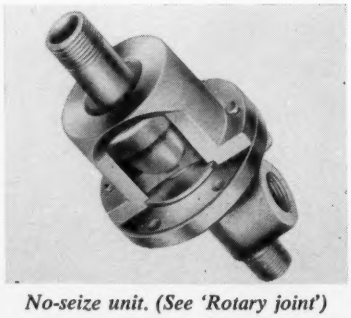
Tension meter
A new instrument from **Tensitron, Inc.** has a range of 1 to 20 lb with great resolution at the low tension end.

It features a novel lever-inserting mechanism whereby two outer rollers are lowered or raised simultaneously. The controlling lever is at the side of the instrument away from the moving material (thus protecting the operator's hands) and the moving material is kept away from the observer at all times.

The rollers are tapered, thus widening the opening where the material to be tested is placed, and at the same time guiding the material into test position. Wide flanges at the bottom of the low-inertia rollers hold the material securely in place, while tension is read as the material travels at production speed. (222)

Screw locks
A new, 8-page specification bulletin has been issued by the **Heli-Coil Corporation** (a Division of Topp Industries, Inc.) on their complete line of Screw-Lock inserts, including the new miniature size 4-40.

The bulletin contains selection tables with thread sizes, insert numbers and sizes, and complete information on drilling, tapping, gauging and installation. Line drawings and photographs illustrate the proper installation of the inserts, both blind and through holes. Also included are basic engineering design data, military specifications, classes of fit and assembly proportions. A variety of illustrated cost-cutting applications demonstrate the reusable locking feature of the Screw-Lock insert to provide permanent threads in any material. (223)



No-seize unit. (See 'Rotary joint')

Mechanical meter
Bulletin 1000 (issued by **Air Conditioning Equipment Corporation**) describes a completely mechanical instrument that measures heat in thermal units and liquid-flow in gallons with high precision. Known as the Pollux BTU integrating meter, it can measure the heat absorbed by a liquid and the heat removed from the liquid. It can also measure the heating and cooling consumed in individual areas. The meter is corrosionproof, easily installed and requires no lubrication. Where required, it can be provided with a remote counter.

The meter can be used in the metering of central heating and refrigeration plants and is especially suitable for measuring the quantity of heating and cooling consumed in individual areas of any type of building. It can also be adapted for use with liquids in many industrial and chemical processes. (224)

High-temperature seals
A new series of high-temperature, high-reliability hermetic seals has been announced by **Consolidated Electrodynamics Corporation.**

Known as the Ceramicite C-200, this is the second series to be added to the family. The material was developed to satisfy the need for a material which would hermetically seal to Type 300 stainless steels. (225)

New products
continued

Metal stampings

Precision metal stampings and deep-drawn parts are illustrated and described in the four-page Bulletin No. 80 just published by **Johnson & Hoffman Manufacturing Corporation.**

To dramatize the size range, page two of the folder shows a very small part held on the tip of a finger and, directly below it, a rectangular stamping which frames the head and shoulders of a man.

Three other photographs show deep-drawn parts, stampings and microminiature parts. The last mentioned are for use in the new General Electric 6BY4 metal-ceramic electron tube.

The folder lists 17 materials used in the production of the parts. Finishes listed are: electropolished, tumbled or plated. Deep drawn parts can be produced in sizes up to 2.75 in. OD and to a depth of 3.75 in. There is virtually no limit to the variety of stampings.

The folder states that emphasis on creative engineering and ingenuity enables the company to save the customer money while insuring precision and quality. (226)

• • •

Coolant

An unusual liquid that acts as coolant, lubricant and rust preventive when mixed with water is proving highly effective and economical in practically every metalworking operation on cast iron, hard and soft steels and other ferrous metals. Details are given in a booklet just released by **Harry Miller Corporation.** Described are 7 different ways in which the coolant (Hamikleer) cuts metalworking costs. (227)

• • •

W type drive

A new type W drive, which features a wide speed and power range, is announced by **The Pfaudler Co.**

The drive is well-suited to a number of requirements because of the extensive range of power and agitator speed possible. The hydraulic drives are available to meet requirements for 100% explosion-proof construction in widely variable speed ranges.

Standard 2.5 W, 3W, 4W and 5W drives are supplied with constant speed sheaves. Standard sheaves with static free belts combine to give any required speed for desirable agitation. Variable sheaves with static-free belts are available to give much greater agitator speed which ranges from 600/120 to 100,20. (228)

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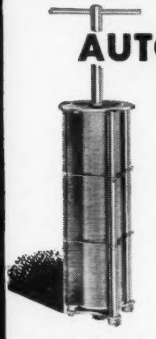
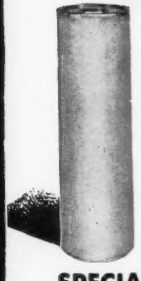
The RIGHT Choice For EVERY Requirement.



AUTO-KLEAN
METAL EDGE-TYPE
Continuously cleanable. Combine small size, high flow rates and low pressure drop. A wide range of models and sizes with capacities to 4000 gpm and filtrations as fine as 40 microns.

MICRO-KLEAN
FIBER CARTRIDGE
New white cellulose cartridge for 5-micron filtration wherever clarity, purity and taste are essential. Wool cartridge for a wide range of 10 to 70 micron applications including compressed air. Housings for flow rates from a few gph to hundreds per minute.



PORO-KLEAN
POROUS STAINLESS STEEL
Cartridges and special forms. Combine extreme heat and corrosion resistance, high tensile strength and very fine filtration (down to 5 microns, standard). Tests prove no contamination from particle discharge.

FLO-KLEAN
WIRE-WOUND
For low-viscosity, high volume (up to 15,000 gpm) filtration. Filtration from .0025" to .030". Filters are completely automatic, continuously self-cleaning without loss of backwash fluid.

SPECIAL FILTERS A unique combination of experience, know-how, complete facilities and services have made it possible for Cuno to successfully solve a very wide range of difficult filtration problems. Special types can be engineered and produced to meet almost any requirements.

FILTRAPOOL SYSTEMS . . . for swimming pools to 70,000 gallons. Low cost, compact, unequalled ease of installation and maintenance.

FLOWS . . . from 1 gpm to 20,000 gpm, full flow or by-pass.
DEGREES OF FILTRATION . . . from .062" (20 mesh) down to 1 micron.
WIDE VISCOSITY RANGE . . . if you can pump it, Cuno can filter it.
HIGH TEMPERATURES . . . to 900° F.
ACIDS, ALKALIES, LIQUIDS and COMPRESSED GASES

CUNO
ENGINEERED FILTRATION

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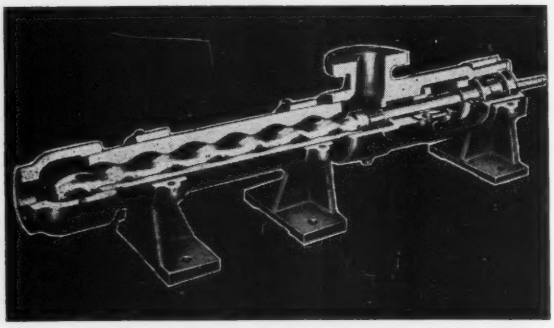
THE PRINCIPLE THAT CAN

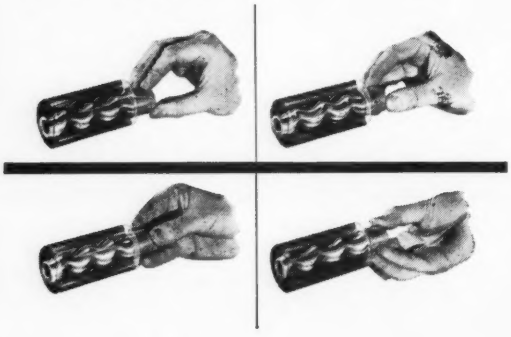
cut your costs



MOYNO®

PUMPS ON, WHERE OTHER PUMPS FAIL

Moyno's exclusive 'progressive cavity' pumping principle makes Moyno the only pump that can handle many abrasives, pastes, slurries, chemicals, suspended solids, non-pourable pastes, etc., without foaming, aerating, cavitating, or excessive pump wear.



As shown above, Moyno pumps have a screw-like rotor turning in a double-threaded stator creating progressive cavities, moving materials smoothly through the pump. Moyno will pump anything that will push through a pipe!

Moyno pumps are available in capacities up to 500 gpm and pressures up to 1,000 psi.

There are various applications where the Moyno can substantially cut costs. Let us show you how. Send us an outline of your pumping problems today, or . . .

Write for Bulletin 30C/D7

THE ROBBINS & MYERS COMPANY
of CANADA LIMITED—BRANTFORD, ONTARIO

WHICH SET SCREW IS THE BRISTOL?

At a glance the two set screws look alike. But identical twins can have very different characters. The extra built-in quality of Bristol screws may not show on the surface, but it does show in longer life, better performance and greater product acceptance. All Bristol screw products are manufactured from specially selected alloy steel, expertly heat-treated, accurately machined to closer tolerances and inspected with painstaking care. The result is perfect fit that speeds assembly and won't work loose. Write our Socket Screw Division for information.

P.S. The Bristol Screw is on the top.

B7R

Precision Socket Screw Manufacturers Since 1913

THE BRISTOL COMPANY OF CANADA LIMITED
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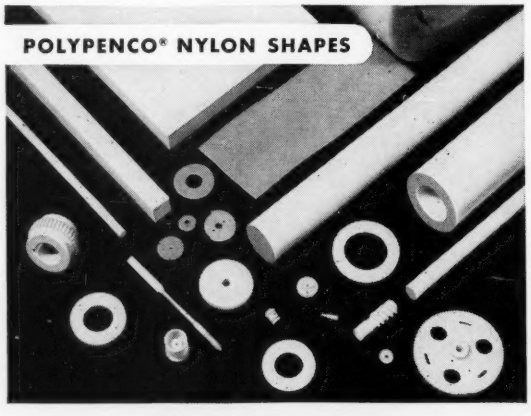

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POLYPENCO

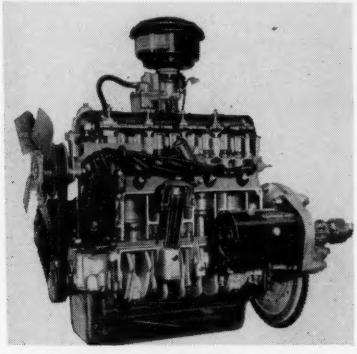
New products
Continued

Industrial engine

A compact, lightweight industrial engine, designed to give more power per lb than other engines of similar horsepower, is announced by **Fageol Products Division,** Twin Coach Company.

Known as the Fageol 44, the engine produces up to 45 hp at 5500 rpm, with a running engine weight as low as 160 lb.

Exceptional fuel economy and high power output in relation to size and weight make the engine ideal for industrial applications where compactness and light weight are important factors in power source selection. Current usages include farm and hoisting machinery, lift trucks, tow tractors, construction equipment, fire pumpers and portable generators. (229)



The new Fageol 44 is less than 24 in. in length. (See 'Industrial engine')

• • •

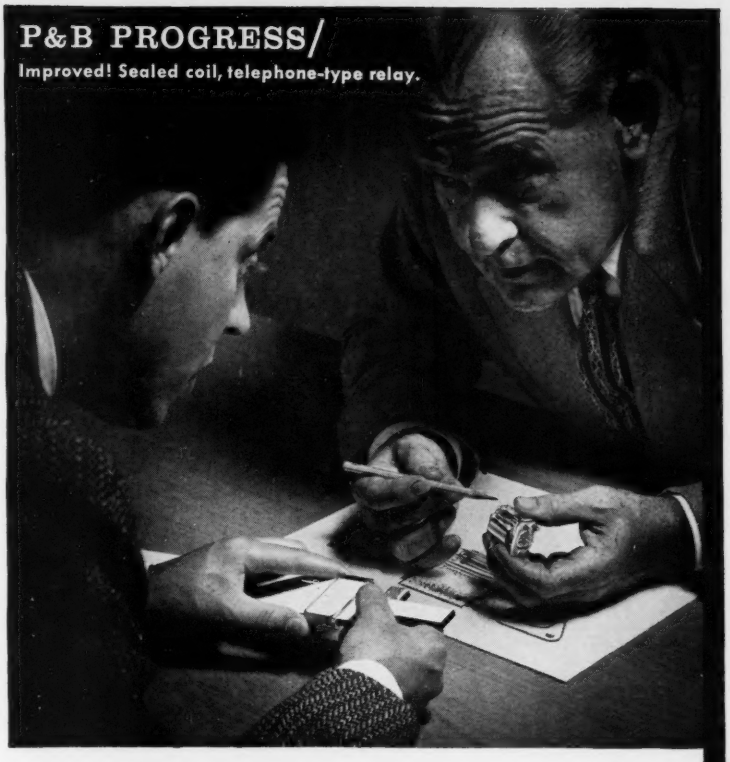
Epoxy putty

A four-page illustrated bulletin recently published by the **Smooth-On Manufacturing Company** describes their Metalset A2 series of aluminum-filled epoxy resin compounds. These products are designed for use in the aircraft, marine and metalworking industries and for any repair or maintenance activity requiring a chemically stable, nonshrinking and nonflammable putty with good adhesion to iron, steel, aluminum, wood, glass or ceramics.

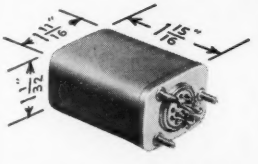
Bulletin 11 outlines many uses of Metalset and describes its numerous advantages, such as ease of mixing, convenient room-temperature curing and machinability. In addition, detailed illustrated descriptions are given as to how the oil and waterproof material should be used for successful application. The various curing agents available to give rapid cure, extreme hardness or maximum adhesion are enumerated. A description of the sizes and packing of the units is included, as well as the proper proportions for mixing the epoxy compound and the various curing agents. (230)

P&B PROGRESS/

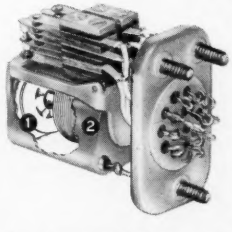
Improved! Sealed coil, telephone-type relay.



New! Dual hermetic seal increases relay reliability and temperature range!



LOOK AT THESE GREAT NEW FEATURES



1. New bobbinless coil saves space, permits use of more ampere turns of Teflon coated wire with no increase in coil diameter.
2. Hermetically sealed coil prevents gases from contaminating contacts.

Hermetically sealing the coil of the MH "Seal-Temp" Relay increases reliability and life . . . eliminates contact contamination due to outgassing of the coil.

The "Seal-Temp" has a temperature range considerably broader than ordinary relays . . . from —65° C to +125° C. This is achieved by constructing the stack of Mycalex, employing ceramic pushers, and by using Teflon coated wire throughout.

Write, wire or call today for complete information.

MH "SEAL-TEMP" RELAY

GENERAL:
Insulating Material: Ceramic, Mycalex and Teflon.
Insulation Resistance: 1,000 meg ohms min.
Breakdown Voltage: 500 V. RMS.
Shock: 30g's.
Vibration: 5g's 55 to 500 cps.; .032" max. excursions 5-55 cps.
Temperature Range: —65° C to +125° C.
Pull-In: Approximately 75% of nominal voltage at 25° C.
Terminals: Miniature plug in; hook end solder.
Enclosure: Short "M" Can, hermetically sealed.

CONTACTS:
Arrangements: Up to 6 springs per stack. (4PDT)
Material: ⅛" Silver (others available).
Load: 5 amp. 115 V. AC resistive.

COILS:
Resistance: Up to 22,000 ohms.
Power: 100 mw per movable arm min.; 4 watts max. DC at 25° C. (200 mw min. to meet shock or vibration requirement at 25° C.)
Duty: Continuous.
Insulation: Teflon.
Coil Chamber: Hermetically sealed.

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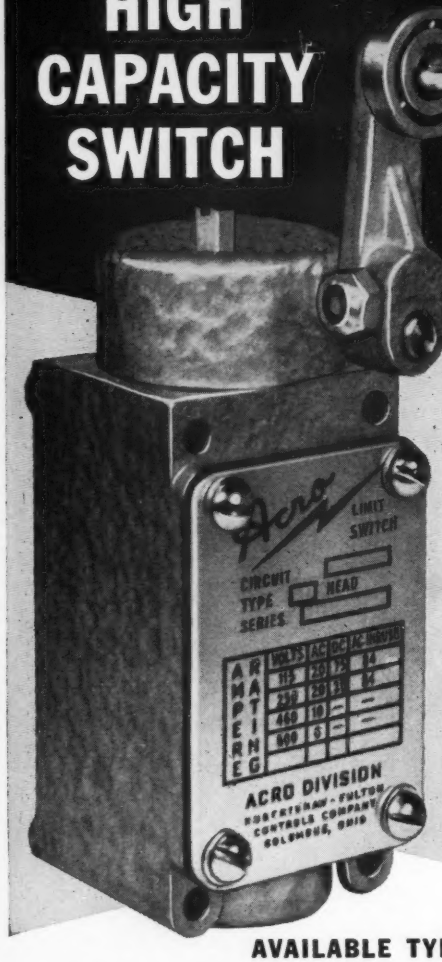

Machine tool and other equipment applications are "naturals" for this Acro high capacity switch, which can control up to four separate circuits on either pilot or line duty. Actuator is adjustable 360° in two planes.

ELECTRICAL RATING

2 H.P. 230 Volts A.C.
1 H.P. 115 Volts A.C.
20 Amps—250 Volts A.C.

Two types available: Double Action Type actuates switch contacts when actuator is moved either side of "at rest" position. Single Action Type operates from one side of "at rest" position only. Both are designed for long life under heavy use.

AVAILABLE TYPES

Catalog No.	Circuit Arrangement	No. Terminals	Action
242-0003-03	Four circuits (two open, two closed)	8	Double
242-0011-03	Four circuits (two open, two closed)	8	Single
242-0010-03	Double circuit (one closed, one open)	4	Double
242-0012-03	Double circuit (one closed, one open)	4	Single
242-0019-03	Double circuit (normally closed)	4	Double
242-0017-03	Double circuit (normally closed)	4	Single
242-0020-03	Double circuit (normally open)	4	Double
242-0018-03	Double circuit (normally open)	4	Single

Write for complete information and application engineering help. Mention ACRO Machine Tool Switch!

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ACRO DIVISION • Columbus 16, Ohio

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New Products
Continued

Panel mounted instruments

A catalogue is available on the panel mounted instruments made by the **Sensitive Research Instrument Corporation.**

These instruments, mounted in rectangular or edgewise cases, are listed to cover the full scale measurement from 1 microamp to 50 amps, from 1 millivolt to 1,500 volts and from 0.05 watt to 3,000 watts. Ratio-meters, conductance meters, flux voltmeters, direct reading frequency meters, electrostatic voltmeters and special instruments to customer specification are available.

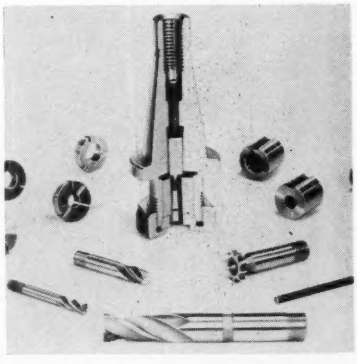
Accuracies to ¼ of 1% of full scale deflection may be specified. (231)

• • •

Chuck

Designed and manufactured by the Small Tools Division of **B.S.A. Tools Ltd.,** a new chuck (the Tru-Lok) is being produced primarily for use with milling machines, but may be adapted to drillers and other types of machine where screwed shank tools are used.

In construction the chuck is quite simple. It is manufactured from high quality heat-treated steel to withstand wear. Cutters can be held in the chuck with complete rigidity under the most



A sectioner chuck with split collets at left, bushes right. (See 'Chuck')

arduous conditions. In fact, under test heavy cuts were employed up to a point where the cutters were virtually destroyed, yet the chuck remained perfectly steady and true and without any evidence of chatter.

Within the body of the chuck there is a bush which accommodates the screwed shank tool. This bush takes the drive of the chuck through a substantial key. A split collet takes care of variation in shank diameters and centralizes the cutters (in conjunction with a back centre) while its closing action eliminates cutter chatter.

A locking nut is threaded over the outside diameter of the chuck body and holds the split collet in position. (232)

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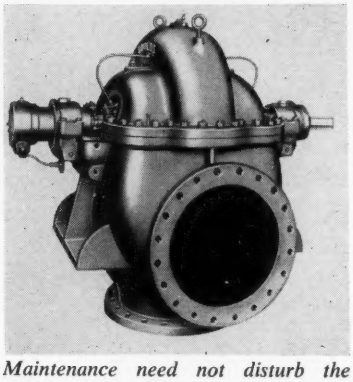
New Products

Continued

High capacity pumps

For capacities up to 25,000 gpm in the marine, petroleum, pulp and paper, and municipal water works industries, **Goulds Pumps, Inc.** has introduced the Fig. 3420-3423, 24 in. pumps. These



Maintenance need not disturb the piping. (See 'High capacity pumps')

pumps have performance characteristics to meet a wide range of applications. Both units are exactly the same except for the lower half casing. Fig. 3420 has horizontal suction and discharge while Fig. 3423 has vertical bottom suction and horizontal discharge.

These single stage, double suction pumps have horizontally split casings with the upper and lower halves bolted and dowelled together. Removal of the upper half casing permits inspection, maintenance and removal of the entire rotating element without disturbing the suction and discharge piping of the pump and driver alignment. The impeller is of the double suction type providing hydraulic balance. It is cast in one piece and all exterior surfaces are machined. (233)

• • •

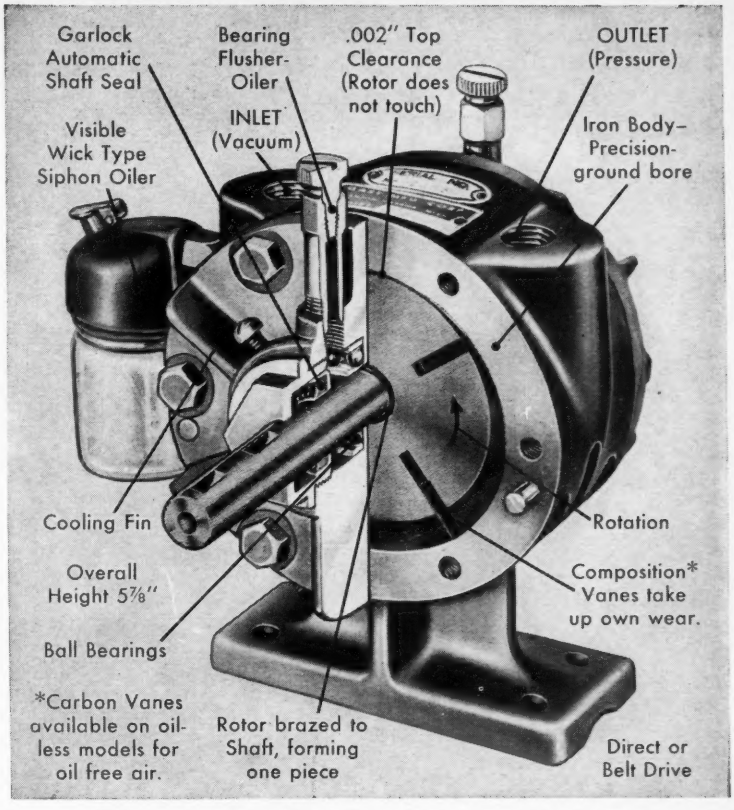
Pipe connections

The steady drip of leaky pipe connections (whether under home sinks or in complex industrial pipe circuits) need no longer be heard.

A thin, nut-like metal fitting just introduced by **Flick-Reedy Corp.** promises to end that wearying (and expensive) sound forever. It seals instantly and permanently when threaded onto a standard pipe connection.

Sealing is accomplished by a dry, milky-white circular insert of Teflon plastic which is resistant to temperature and chemically inert. This means that it can be used in lines carrying oil, water, gas, air, steam, chemical fluids or milk.

Called the Tru-Seal fitting, it holds its seal under ultimate pressures of 10,000 psi and temperatures from 200 F to 500 F. (234)


Garlock Automatic Shaft Seal
Bearing Flusher-Oiler
.002" Top Clearance (Rotor does not touch)
OUTLET (Pressure)
INLET (Vacuum)
Visible Wick Type Siphon Oiler
Iron Body–Precision-ground bore
Cooling Fin
Rotation
Overall Height 5⅞"
Composition* Vanes take up own wear.
Ball Bearings
*Carbon Vanes available on oil-less models for oil free air.
Rotor brazed to Shaft, forming one piece
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rotary vane

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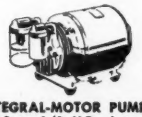
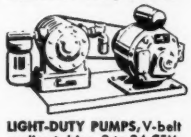
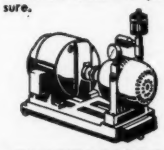


INTEGRAL-MOTOR PUMPS 1/12 to 1/3 H.P. .6 to 4 CFM. to 28" VAC., to 25 PSI.



LIGHT-DUTY PUMPS, V-belt or direct drive. 2 to 24 CFM. Moderate vacuum or pressure.



HEAVY-DUTY PUMPS, 1/4 to 1-1/2 H.P. 4 to 21 CFM. To 28" VAC. or 30 PSI. Cooling fans and fins.

As original components—or for special plant use—Gast Air Pumps offer important advantages. This cutaway reveals many reasons why they are specified as "original equipment" by more and more leading manufacturers.

All models are built to high quality-precision standards in a new, modern plant. All embody this inherently efficient, simple rotary-vane design. Balanced rotor is free of vibration. Sliding vanes are light in weight—for minimum motion-energy-friction loss compared to other pump designs. As vanes take up their own wear automatically, pump delivers full performance through years of use.

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- COMPRESSORS TO 30 P.S.I.
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SEE OUR CATALOG IN SWEET'S PRODUCT DESIGN FILE

Abstracts

Wanted: Product design engineers

For the purpose of this paper a product design engineer may be considered as one with a technical education, practical training and initiative, who can translate an established objective into a useful, manufacturable and salable product.

In most cases new graduates cannot reasonably be expected to meet these full qualifications, and additional training will be required to develop them into the product design engineers of the future. We venture to explore some of their relationships to industry, together with some of the objectives in product design. The subject is approached from five viewpoints:

1. What does industry expect of the graduate engineer?
2. What may the graduate expect from industry?
3. What are the characteristics of a good product engineer?
4. What are the objectives in product design?
5. What of the future in product engineering?

(From an SAE paper by C. J. Scranton, Allis-Chalmers Manufacturing Co.

Stepped extrusions

The rapidity with which the technology of extrusion has advanced in recent years has greatly broadened the field of application for light metals. To previously acquired knowledge has now been added techniques for obtaining an aluminum extrusion with two or more different cross-sections. These extrusions can be used to simplify design, reduce machining and cut materials cost. Recently introduced, the "stepped extrusion" is already being used for aircraft spar cap applications in the U. S. and for street lighting poles in Europe. Engineers predict many applications for it in the near future.

(From Aluminium News, technical note 114)

Reinforced holes in plates

The presence of a uniform reinforcement around a circular hole in a plate loaded in its own plane results in a decrease of the stress concentration. It has been shown that when the weight of the structure (that is, plate plus reinforcement) is constant, this stress concentration can be further reduced by suitably varying the cross-sectional area of the reinforcement. Thus, when the maximum stress is nowhere to exceed a given value, the effect of varying the cross-sectional area of the reinforcement is to decrease the necessary weight of the structure.

In an article by Raymond Hicks (Engineering 1957, page 280) expressions are obtained for the radial, tangential and shear stress components in an infinite plate under the action of (a) constant shear stresses, and (b) unequal principal stresses. These expressions are written in terms of a set of arbitrary constants which can be evaluated for any particular numerical example.

Gear tooth fatigue

A paper presented by T. F. Davidson and P. M. Ku before the American Society of Lubricating Engineers dealt with the effect of lubricants on gear tooth surface fatigue (pitting).

It reported that the progress made at Southwest Research Institute on an investigation sponsored by Wright Air Development Center. An important aspect of this investigation was the development of a laboratory test method that would produce limiting pitting within a conveniently short time. Several criteria for defining limiting pitting were considered. The definition found most satisfactory was the incidence of pitting on three nonconsecutive gear teeth of such severity as to be clearly discernible without magnification. Using this test method, a program was instituted in which the performance of 12 lubricants, covering a wide range of viscosity, Ryder gear rating and corrosivity, was determined.

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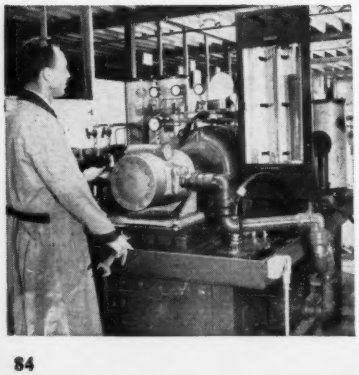

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Solid film lubricants

The behaviour of several solid film lubricants has been experimentally established as a function of temperature. These films are formed of a suspension of lubricant particles (graphite, molybdenum disulfide) in a thermosetting resin baked onto a hard surface. The test consists of heating such a layer and continually observing the friction coefficient until failure. Sliding conditions of high unit loading and low rubbing velocity were chosen to provide a comparison between the films. They were evaluated as to the highest temperature for which the friction coefficient remained low and subsequently as to the number of load cycles sustained at temperature before an abrupt increase in friction. Results for all films were similar in that failure was caused by a breakdown of the binder rather than of the graphite or MoS_2 and that the minimum friction coefficient was observed just before the film failure at temperatures as high as 1200 F. Good endurance characteristics were observed at these high temperatures.

(from an ASLE paper by E. P. Kingsbury of MIT)

Adjustable speed drives

Requirements for adjustable speed driving motors in the engineering industry are many and varied, covering all sizes of machine. The ultimate choice depends upon many factors, among which can be mentioned speed range, dependability of load upon speed, long-term stability, method of control, accuracy and, of course, economic considerations.

For a large number of industrial applications, various types of ac motor can be used in conjunction with variable ratio gear boxes. In general, however, these arrangements are limited to situations where relatively small speed variations are required and it is unimportant if the speed varies to some extent with respect to the load.

Where a wide speed range is necessary, together with choice of either a constant torque or constant hp characteristic, the dc machine (with suitable power conversion and control equipment) has for a long time provided the most acceptable answer.

(From The Bepco Journal, No. 8, 1957, by R. M. Herbert.)

Composite castings

The development of composite castings (made by casting aluminum bronze on a steel core) enables the physical properties of the aluminum bronze to be combined with the relatively low cost of steel in the manufacture of a wide range of components. An article entitled "Composite castings of aluminum bronze and steel" by C. H. Meigh and G. E. E. Marshall on page 594 of Engineering 1957 describes a few of the features encountered in this particular production method.

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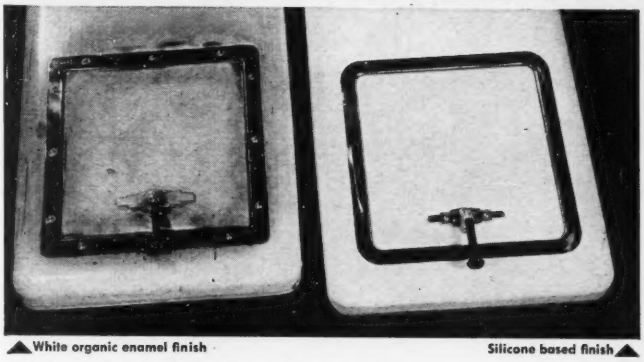

White organic enamel finish — Silicone based finish

Here's the kind of superior color and gloss retention you can expect with paints based on Dow Corning silicone resins. After a few weeks exposure to temperatures up to 500 F, the finish on the incinerator cover at left is ruined, whereas the silicone based finish on the cover at right looks like new.

Finishes based on Dow Corning silicones provide superior resistance to corrosion and weather.

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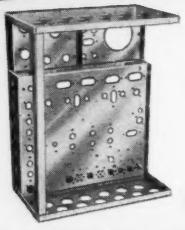

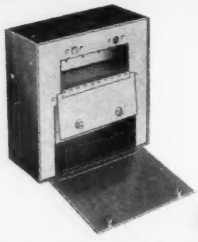

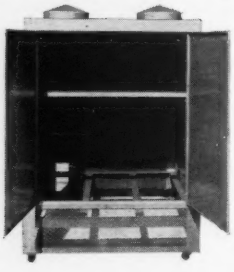

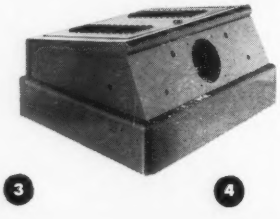

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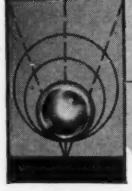
Hartford's Look Ahead Policy anticipates increasing engineering requirements. The balls are manufactured to increasingly close tolerances and finer surface finishes from a wide range of materials able to withstand increasingly higher temperatures, more severe corrosive conditions and unusual wear problems.

Many difficult bearing problems are solved by Hartford engineers. For example, through unitization of parts, miniaturization and reduction in tolerance build-up is achieved with VERSA-TWIN, a double-row ball bearing in which parts of the end product form the inner and outer races. This bearing can be custom designed to your specific requirement.

Hartford also makes a complete line of thrust retainers, angular contact and wheel bearings. Technical literature is available on all lines.



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New Products

Continued

Cadmium brightener

Faster plating action, increased brightness and a longer brighter life are the claims made for Cad-Kote, the new cadmium brightener, just introduced to industry by **Smoothex, Inc.**

Successful in the laboratory, it proved to be amazing in its performance in the field. The consistently bright deposits created by the new brightener impart an extremely high lustre to the entire surface of all the parts. Plating time is reduced because the need of subsequent bright dipping is eliminated.

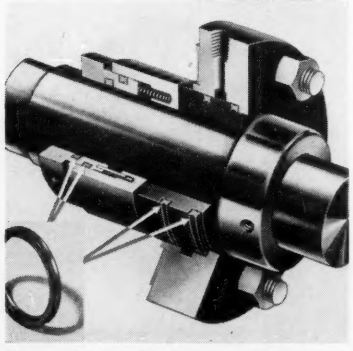
1 lb of cadmium covers an area of approximately 112 sq ft, when applied to a thickness of 0.0002 in. Because it is anodic to iron, it affords maximum protection against corrosion, even if the pores, nicks or scratches in the ferrous base metal are exposed. The coating must corrode before the iron itself is attacked.

Surfaces, plated with cadmium, are easily and economically soldered. This property makes it ideal for the manufacture of electrical products. Tests prove that soldering can be done as efficiently on Cad-Kote plated parts as on tin-dipped surfaces. (235)

Sealing

Results of an extensive testing program have led to the adoption of Quad-Rings (developed by **Minnesota Rubber & Gasket Company)** in many specialized and exacting applications by Durametallic Corporation, manufacturers of engineered mechanical shaft seals.

This company, which had been using O-rings as the sealing element for types



Not subject to the spiral twist of O-ring shaft seals. (See 'Sealing')

generally recommended for use at temperatures up to 250 F, became interested in Quad-Rings for certain applications and instituted a testing program. Even though O-rings were satisfactory in many instances, they occasionally failed in moving seals, due to spiral twist. (236)

SEALING DOMESTIC APPLIANCES IS A REAL CHALLENGE, TOO!

Standard 6A Seal with specially designed seat conforming to impeller contour so as to promote good water flow characteristics.
Limited axial room and large diameter are mechanical requirements in this washing machine seal. Design features multiple spring construction for even face loading.
FIVE ADAPTATIONS OF THE John Crane TYPE 6A SEAL for four different appliance manufacturers
Seal features outer periphery face construction to best service garbage disposal conditions.
Two sealing points in a washing machine with widely differing physical limitations, yet seals for both retain full advantage of diaphragm action, shouldering points and positive drive.

Soapy water, detergents, bones, grit and lint . . . all these combine to make appliances a hard-to-handle sealing problem. Add that to a very limited space factor, and you've got a real set of conditions on your hands.

"John Crane" engineers have solved these problems and thousands of other shaft sealing applications on all types of commercial and industrial equipment. We know that we can be of the same help to you.

That's why . . . as one design engineer to another . . . we urge you to let us work with you in adapting or developing the proper seal for your application.

Tell us about your requirements or write for our fully illustrated Bulletin S-204-3 on "John Crane" Shaft Seals.

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Capable of continuous service at temperatures as high as 250°C.,

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- Teflon insulation available on magnet wires, lead-in and hook-up wires and power cables in a complete range of sizes.
- Meets all these specifications, where applicable: MIL-W-19583, MIL-W-16878B (Types E & EE), MIL-W-7139A.
- Teflon-insulated wires and cables remain flexible even at −100°C.
- It is inert to practically all chemicals and solvents. Unaffected by outdoor weathering or fungus. Extremely resistant to moisture absorption.
- Teflon insulation is non-flammable—has good arc-resistance and will not track.
- Produced with excellent dielectric characteristics over a wide range of temperatures and frequencies.
- Processed for increased abrasion resistant qualities.
- Multi-conductor cables available.
- Wires of all metals and alloys, such as Resistance, Thermocouples, etc. can be coated with Teflon.
- Available in solid colours and combination of braided tracers.

**TEFLON is a Du Pont trade mark*

TRADE
REGIS

Canada Wire and Cable Company Limited

Factories:

TORONTO • MONTREAL • FORT GARRY • VANCOUVER

Magnet Wire Division: Simcoe, Ontario

A Canadian Company Manufacturing and Selling Coast to Coast

Letters

Slide charts

In the September 1957 issue of "Design Engineering" there is an article on page 74 on slide charts. We are particularly interested in the sampler (known as the Idea Starter Kit), and would therefore appreciate your advice as to the address of the Perrygraf Corporation.

from J. Brooksbank, P.Eng., Development Division, Decca Radio (Canada) Ltd., 23 Six Points Rd., Toronto 18, Ont.

In the current issue of Design Engineering, I found the article on page 74 "Slide charts: a big squeeze on facts" most interesting. A selection of 16,000 charts no doubt contains some of particular interest to our field.

Have you a list of the charts available from which we could select? Alternatively, our interests lie in the following subjects: automotive design, commercial art, technical illustration, graphic arts, color harmony, industrial photography, personnel relations.

Another point of interest would be a chart of relative ratios of consumer price index to average hourly wage rates, from which we could see at a glance percentage increases from year to year.

Will you also include a price list of the charts, also the cost of the sampler Idea Starter Kit.

from K. A. Pluck, Brantford Coach and Body Ltd., Brantford, Ontario.

(Since we did not have a selection of slide charts in the office, we advised our readers to contact the Perrygraf Corp., 150 S. Barrington Ave., Los Angeles 49, Calif.—Ed.)

Fishbone connector

We are interested in further information on the furniture fastener illustrated in the October issue of Design Engineering. This fastener is shown on page 77 and carries an item No. 212.

We would like to thank you in advance for any information you can make available to us.

from Murray Waghorne, P.Eng., Manager, Mac Craft Industries, Harbour St., Sarnia, Ont.

(The fishbone connector is made by Funco Products 450, Lincoln St., Denver, Colorado—Ed.)

Mobile ladder

I should be grateful if you would arrange to have literature sent to me describing the mobile ladder, No. 226 in your May 1957 issue.

from C. H. Conroy, P.Eng., Chief Engineer, Department of Public Works, St. John's Newfoundland.

(We supplied the address;—Magline of Canada Ltd., Renfrew, Ontario—Ed.)

NEW WONDER COATINGS FOR INDUSTRY FROM EPON* RESINS

- guard against corrosion
- stand up to rough treatment
- resist heat and chemicals

Surface coatings based on Epon resins withstand strong acids, lacquer solvents, hot concentrated sodium hydroxide, and concentrated liquid detergents. This chemical resistance is combined with outstanding adhesion to almost every type of substrate. Flexibility permits you to coat sheet material before forming.

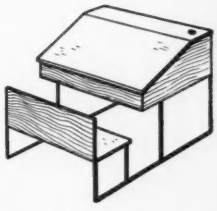
Epon based finishes are scuff resistant. Take daily scrubbings and buffings on surfaces exposed to rough treatment.

You can brush, roller coat, flow coat, dip or spray. These finishes are dry in as little as 15 minutes and may be baked at a variety of ranges. Some formulations can be air dried to give the properties of a baked finish.

When ordering surface coatings, be sure to specify those based on Shell's Epon resins.

*Registered Trade Mark

Water tanks: Coatings based on Epon resins are particularly suitable for tanks. Accidental denting of the outside of a tank will not cause a break in the lining.

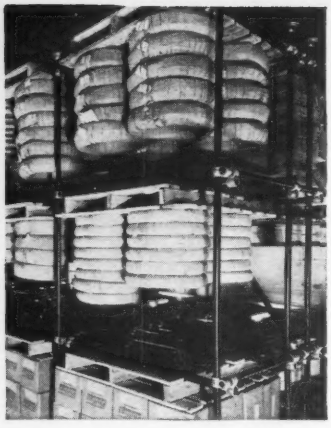


Furniture: Perfect for both indoor and outdoor furniture. Coatings insure great durability. Superior hard surface stands up to continuous scuffing, wear and tear.

SHELL

EPON resins

Chemical Division
SHELL OIL COMPANY OF CANADA, LIMITED
Toronto Montreal Vancouver

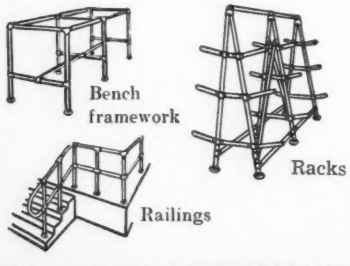


Storage Racks — Guard Rails made easily with KEE KLAMPS —

the malleable, galvanized fittings with the case-hardened grub screws.

Your unskilled labour can cut Standard Iron Pipe, insert it in the KEE KLAMP (no threading) and tighten the grub screw with an Allen wrench. It's as simple as that.

We will suggest the most economical design for your purpose when you ask us for a quotation.



There are 50 types of KEE KLAMPS for pipe from ½" to 2". Write for catalogue and Canadian Stock List.

KEE KLAMP DIVISION
of O'Donnell-Mackie Limited
97 Wingold Ave., Toronto 10
RUssell 7-3911

Book Department

Brittle Behavior of Engineering Structures by Earl R. Parker (Wiley) summarizes the available information on the brittle behavior of steel in engineering structures. It contains a discussion of the theories and mechanism of failure, a review of test methods used for evaluating relative brittleness, interpretations and summaries of test results, a discussion of the effects of welding composition variations on notch toughness and a report of service failures.

In presenting a clear picture of the state of knowledge, the book is of value to anyone who wants to learn where we stand in the field of brittle-fracture prevention. It also offers a valuable survey of the fundamental properties and fracture theories.

Design of Steel Structures by Edwin and Charles Gaylord (McGraw-Hill). This book deals with the design of structural members and their connections, with applications to steel bridges and building frames. In addition, some attention is given to aluminum, because of its increasing importance as a structural metal. Understanding of the basic philosophy of structural design is emphasized. The book includes a thorough discussion of the ordinary loads for which bridges and buildings must be designed, and, in addition, a discussion of earthquake loads and blast loads. This is followed by sections on the design of structural members in steel and aluminum; welded, riveted and bolted connections; plate-girder bridges; and industrial and multistory buildings. Finally, there is a chapter on the application of theories of ultimate strength or plastic design, as it has been called.

This gives the student an introduction to this development and an opportunity to appraise the elastic theory as a basis for design.

Each topic is introduced with a discussion of the relevant theory and with references to experimental evidence, wherever feasible. The relation of theory and tests to standard design specifications is emphasized. Illustrative examples and problems follow this introduction. Every effort is made to relate both examples and problems to practical situations.

There are new and original treatments of bending about both principal axes, of lateral-buckling characteristics of beams subjected to such bending, and of several other topics. There are adequate references to the literature of this subject to help the student who wants to pursue further some topic of interest, and to help particularly the practicing engineer.

Centrifugal and Axial Flow Pumps by A. J. Stepanoff (Wiley). This, the second edition, has been revised and expanded to include the considerable progress in the theoretical reasoning, design and application of centrifugal pumps, which has taken place since publication of the first edition.

The author retains the theoretical treatment of the impeller action and casing performance and the method of presenting experimental information. He includes a number of new topics dealing with theory, design and application.

Major additions include: Water-hammer problems in centrifugal pump systems; new material on centrifugal-jet systems; thermal cavitation criterion to correlate cavitation data on the basis of physical and thermal properties of liquids; a new viscosity chart; complete characteristics of axial and mixed flow pumps; numerous design refinements and the latest data.

Theory and Practice of Lubrication for Engineers by Dudley D. Fuller (Wiley). Once the principles of friction lubrication are thoroughly understood, they can be used time and time again, to meet the whole spectrum of practical lubrication problems. In this work (the first to give balanced treatment to the theory and practice in lubrication) basic concepts are organized in the manner the author has found most practical in his teaching experience. After presenting a solid foundation in the theory of lubrication, he applies principles to a wide range of lubrication problems. Numerous examples are worked out in the discussion of problems. Many bearing designs are given, including, amongst others, those for machine tools, turbines, generators, large motors, rolling mills, ball mills and centrifuges.

For researchers, Professor Fuller has deliberately included much material that should kindle the imagination and lead to individual study. Direct references are made to outstanding examples of recent research in lubrication. The techniques used and results achieved are included in discussions. The book is claimed to be the first volume to fill the gap between theoretical and applied lubrication, and also the first book to offer a complete treatment in English of hydrodynamic theory, with emphasis on the engineer's point of view.

Changing your address?

If you change your address be sure to notify our subscription department quoting both your old and new addresses.

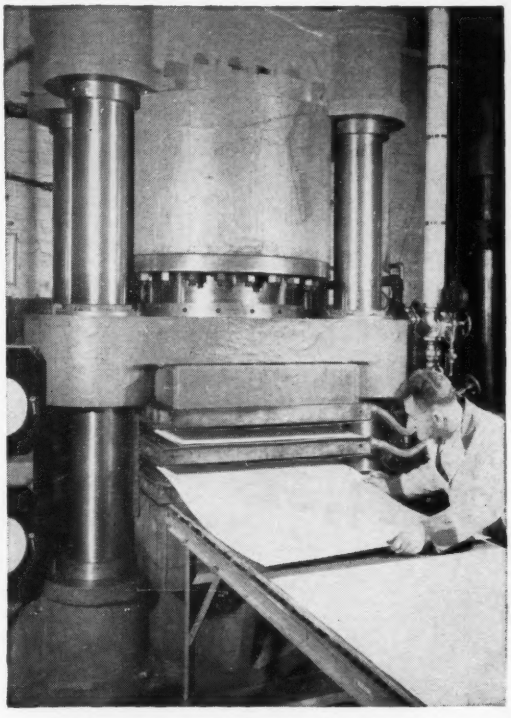
DU PONT CANADA

PRODUCT ENGINEERING NEWS

PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

Large Sheets of TEFLON* Moulded in Canada

Jos. Robb & Co. Ltd., and Anchor Packing Co. Ltd. Announce New Production Facilities

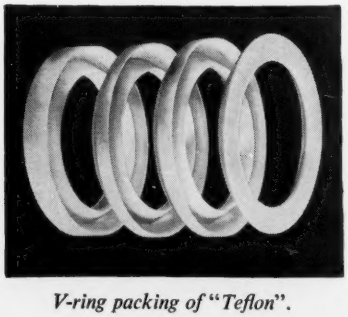


1800-ton press making Anchor "Teflon" Sheet.

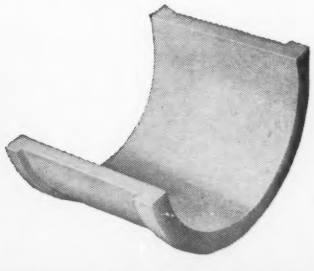
Du Pont's tetrafluorethylene resin, "Teflon", is being moulded into large-size (36″ x 36″) sheets by Jos. Robb & Co. Ltd., 5575 Côte St-Paul Road, Montreal, the company recently announced. This marks the commencement, in Canada, of a new product line which has shown amazing growth in the United States in recent years.

"Teflon" has an exceptional combination of properties not found in any other material. It is characterized by virtually complete chemical resistance, non-toxicity, extremely low coefficient of friction, moderate flexibility even at extremely low temperatures, outstanding electrical insulation properties including very low loss at high frequencies, together with sufficient heat resistance to permit exposure to continuous temperatures in the order of 500°F in many uses. As a result, the material is finding wide acceptance for gaskets, packings, valve rings and discs, and diaphragms which require its chemical resistance, flexibility and self-lubricating properties; bearings, non-adhesive coatings, mould-release coatings, and other machine parts, tank and duct linings, etc. . . . which require low friction and non-adhesive properties; high-temperature hook-up and magnet wire covering, coaxial cable insulation, and a variety of moulded electronic parts which utilize its remarkable dielectric and heat-resistant properties.

In addition, Jos. Robb & Co. announced that other forms, such as rod, tube and film, can also be made from "Teflon" and that special shapes or mouldings can be produced to customer's specifications.



V-ring packing of "Teflon".



Moulded saddle bearing of "Teflon".

This is a very positive step forward in the creation of products to meet specific Canadian needs, using the most up-to-date materials available. "Teflon" is only one of a family of outstanding engineering materials sold in Canada by Du Pont Company of Canada (1956) Ltd., and through the use of which many sound business opportunities are developing in the Canadian market. Let us tell you more about them. Call or write our Technical Service Representative, or fill in the coupon (overleaf) for further general information.

OVER

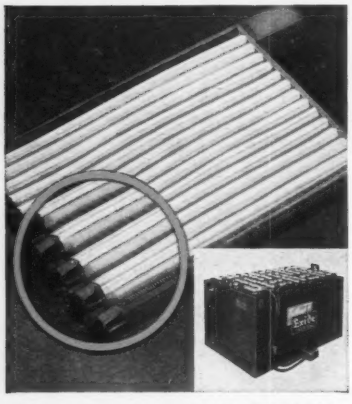
*Trademark of E. I. Du Pont de Nemours & Co. (Inc.)

DU PONT CANADA

PRODUCT ENGINEERING NEWS

PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

ZYTEL* nylon resin fills need for long wearing, lightweight parts in new speed governor



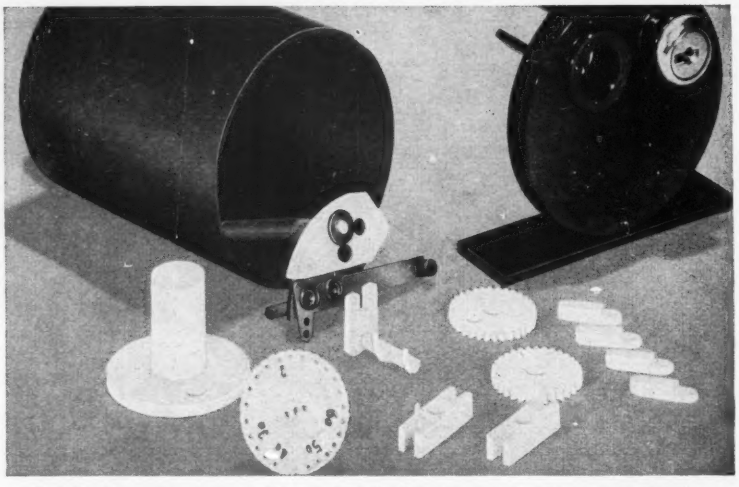
Slotted tubes of ALATHON* extend battery life

THE TUBES in this Exide-Ironclad industrial battery are extruded from "Alathon" polyethylene resin. They are slotted, as shown in the illustration, to permit the active material on the surface of the core to be exposed to the electrolyte. With these slotted tubes, the active material is retained better during the charge-discharge cycle and the working life of the battery is extended.

The decision to switch from rubber tubing material to "Alathon" was made by Exide after years of research, field testing and successful use. Exide engineers expect an increase of up to 20% in battery working life as a result.

"Alathon" won't corrode or erode. It is lightweight, flexible, and strong. Low temperatures will not affect the strength and flexibility of this engineering material. (Batteries manufactured by the Electric Storage Battery Company, Philadelphia, Penna.)

FOR MORE INFORMATION, MAIL COUPON



Including the case, fourteen parts of Du Pont "Zytel" nylon resin are used on this governor. "Zytel" is durable and provides the lightness necessary to minimize inertia—the parts weigh only 5½ ounces. Parts molded of "Zytel" by F. J. Kirk Molding Company, Clinton, Massachusetts.)

THIS SPEED GOVERNOR is mounted under the dashboard of a car or truck. When allowable speed is exceeded, a set of contacts in the governor breaks the vehicle's ignition circuit and thus controls the vehicle's speed.

Including the case, fourteen parts of Du Pont "Zytel" nylon resin are used on the governor. "Zytel" offers the good electrical properties needed in this application and is light in weight to help minimize the inertia of the moving parts. It also offers exceptional abrasion resistance and bearing properties which help reduce wear. In a recent test, the governor was run continuously for two weeks at a speed equivalent to 600 mph. Absolutely no wear was visible on the bearings, gears or other moving parts.

Intricately shaped precision pieces like gears and bearings can be mass-produced by the injection molding process when made of "Zytel"... these parts usually require no further finishing. The method is efficient and can mean substantial savings in production costs.

For complete information on properties and application data of Du Pont "Zytel" nylon resin, write to Du Pont Company of Canada (1956) Limited, Chemicals Department, P.O. Box 660, Room A-4, Montreal, Que.

DU PONT COMPANY OF CANADA (1956) LIMITED — DE-11
CHEMICALS DEPARTMENT, P.O. Box 660, Room A-4, MONTREAL, QUE.

Please send me more information on the Du Pont plastic engineering materials checked: ☐ *"Zytel";* ☐ *"Alathon";* ☐ *"Teflon";* ☐ *"Lucite". I am interested in evaluating these materials for*

NAME _____ POSITION _____

COMPANY _____

STREET _____

CITY _____ PROVINCE _____

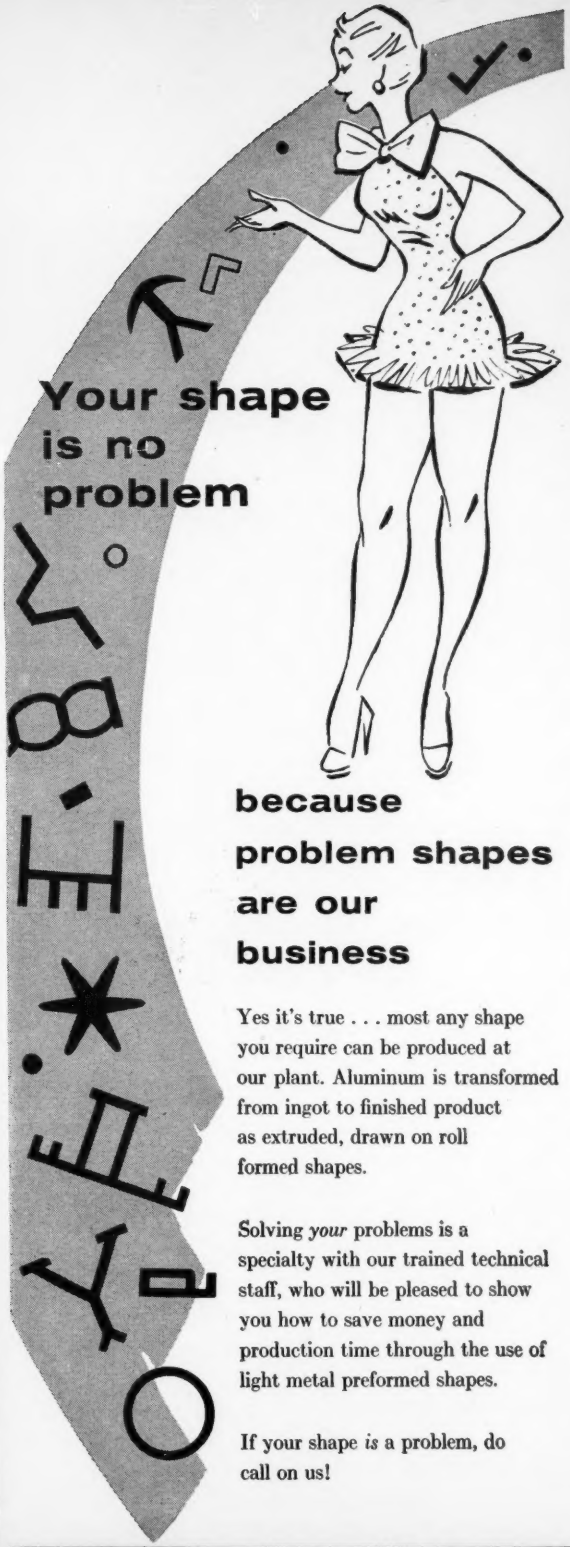
TYPE OF BUSINESS _____

*"Alathon", "Lucite", Teflon" and "Zytel" are registered trade-marks of E. I. du Pont de Nemours & Co. (Inc.)

Investigate DuPont engineering materials in your product development programs

One of the family of these versatile engineering materials is often a key factor in product improvement or new product design. The wide range of properties, available with "Alathon"* polyethylene resin, "Lucite"* acrylic resin, "Teflon"* tetrafluoroethylene resin, and "Zytel"* nylon resin, are helping solve industrial design problems.

NEED MORE INFORMATION? Clip the coupon for additional data on the properties and application of these Du Pont engineering materials.



because problem shapes are our business

Yes it's true . . . most any shape you require can be produced at our plant. Aluminum is transformed from ingot to finished product as extruded, drawn on roll formed shapes.

Solving *your* problems is a specialty with our trained technical staff, who will be pleased to show you how to save money and production time through the use of light metal preformed shapes.

If your shape *is* a problem, do call on us!

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ALUMINUM
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"POP" RIVETS

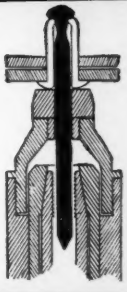
√SPEED PRODUCTION
√CUT COSTS
in METAL FABRICATING

WHERE ECONOMY, SPEED AND DURABILITY ARE OF PRIME IMPORTANCE

Combining great strength with high clinching power, "POP" Riveting requires only one unskilled operator and one simple, fast operation. As many as 1,200 "POP" Rivets can be set per hour by a single operator! And, "POP" Rivets cost less.

"POP" Rivets are now being used at great savings by makers of truck bodies and trailers . . . railroad cars . . . store display equipment . . . industrial air ducts . . . sheet metal roofing...kitchen cabinets...aircraft...metal furniture, aluminum windows and doors...and other metal fabrication industries. Potential uses of "POP" Rivets are limited only by the ingenuity of design engineers who are offered complete freedom of design. Through a combination of superior fasteners and advanced tooling design, you need no longer compromise your engineering for ease of assembly. Where solutions to fastening problems call for low cost, high strength and durability, call for "POP" Rivets.

Photograph of POP RIVET application


Rivet and Tool in Position Before Setting

After Setting—Mandrel Head Retained

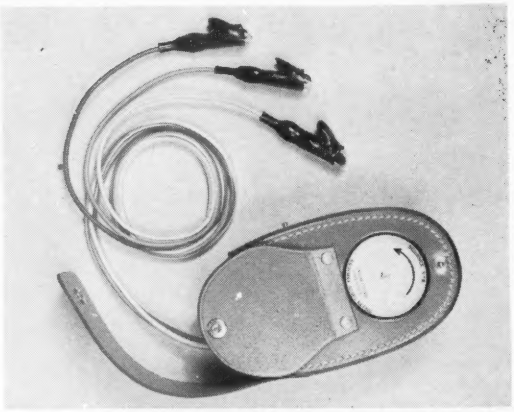
UNITED SHOE MACHINERY COMPANY
of CANADA Limited
MONTREAL TORONTO GALT QUEBEC

Ideas round-up continued from page 74

Phase sequence indicator: weighs only 14 oz

The English Electric Company has added a portable phase-sequence indicator to its wide range of instruments. This indicator is invaluable to erection and installation engineers for ensuring that polyphase instruments, alternators, motors and so on are connected correctly. It is of compact construction, weighs only 14 oz, complete with leather case and can easily be carried in the pocket.

The phase-sequence indicator is basically a simple induction motor with a conventional 3-phase stator winding and a rotor in the form of a pivoted light alloy disc. When the leads are connected in the sequence Red, Yellow, Blue, the disc (clearly marked with an arrow) revolves in the conventional anticlockwise direction. Robust leads, 3 ft long, are led from the neat plastic case of the instrument through a transparent protective sleeve and terminate in strong insulated spring clips designed to protect the operator when making connections.



It weighs a mere 14 oz., complete with a leather case.

A sturdy leather case is provided. The indicator can remain in its case when in use, the dial being exposed by folding back a small flap. The leads are accessible through a further flap at the bottom of the case.

Rated at 50-650 volts at 20 to 400 c/s, the indicator can be left for ½ min at the highest voltage. (237)

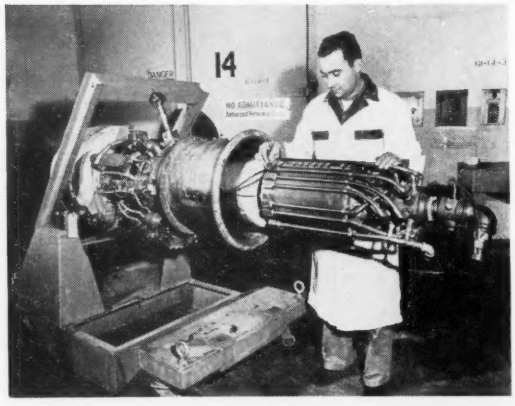
Hydraulic dynamometer: for testing gas turbines

Unusual flexibility and simplified test procedure has resulted from the installation of a new high speed-high power absorption device used in performance testing gas turbine engines at the Stratford, Connecticut plant of Lycoming, a Division of Avco Manufacturing Corporation. An indication of the value of this test apparatus is that it has been in almost continuous service (on a two-shift basis) since it was put into operation in August, 1956. The power absorption unit (a model WWX-650 Hydra-Brake hydraulic dynamometer) operates at approximately 6,000 rpm in absorbing power for 825 shp type T53 engines on test. Although relatively small, the dynamometer can absorb up to 3,000 shp continuously at 7,000 rpm and can be operated at even higher speeds.

Designed and manufactured by Industrial Engineering Company, it consists basically of an hydraulic cylinder with rotor and stator discs. Water at constant input pressure is forced through the cylinder. The Hydra-Brake is mounted on a torque shaft which is connected in turn to the engine shaft. Power is absorbed by a combination of pumping and shearing action with acceleration and deceleration of the water as it passes through the unit.

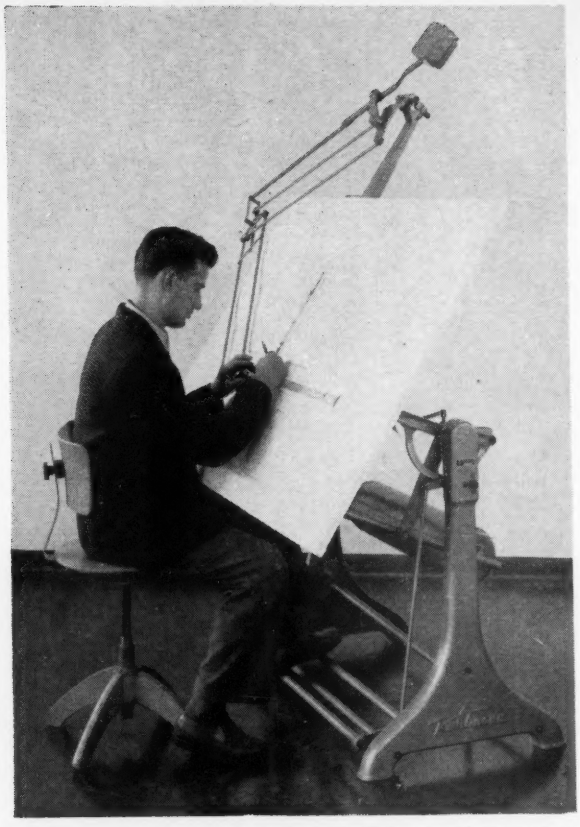
Benefits of this new test apparatus are indicated by the following data: (1) The Hydra-Brake is of only 12 in. diameter, 20 in. long and weighs under 300 lb. Electric dynamometers capable of handling the equivalent horsepower-speed range would occupy approximately a 6-ft cube and weigh around 7 tons. (2) Hydra-Brake, torque shaft and gas turbine engine can be mounted and aligned as an integral unit in the assembly area and can be shipped from there to the test cells.

If an electric dynamometer were employed, it would require permanent installation in the test cell. (3) Total cost of the Hydra-Brake installation is approximately 1/3 that for an electric dynamometer of comparable capacity.



A test cell operator at Lycoming's plant makes some final adjustments to a dynamometer (r) for absorbing power from the 825 shp gas turbine which is at left.

Horsepower of engines under test is readily computed from strain gauge and speed indicator instrumentation. Strain gauges, mounted on the torque shaft that transmits power from engine to Hydra-Brake, measure and report engine torque. This torque data, together with shaft speed measurements, is used to determine engine performance. (238)



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is the world's largest and leading manufacturer of Precision Drafting Machines.

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Extensive research, combined with the highly skilled workforce of Kuhlmann, bring you the reliable drafting machines with the features most wanted by today's draftsmen.

A selection of compiled facts from the Battelle Report and other sources on "How to save Money and Manpower in Engineering" is available free upon request.

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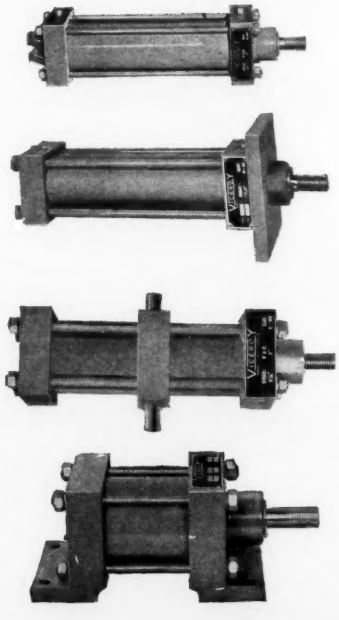
VICEROY CYLINDERS



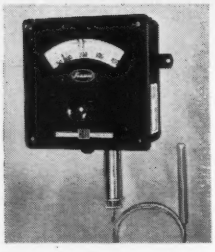
When you look at the finer points of construction that are so apparent in VICEROY cylinders, you will be convinced that for rugged, dependable service you should always choose **VICEROY.**

END CAPS: Solid or Welded Steel depending on diameter of bore.
CYLINDERS: BARREL DRAWN SEAMLESS BRASS TUBING. (Drawn Seamless steel tubing can be supplied if required and specified.)
PISTONS DURAL: For corrosion resistance and lightness.
PISTON RODS: Stainless Steel for added strength and corrosion resistance.
PISTON PACKINGS: Best Chrome Tanned Leather (or other materials most suitable for service specified.)
PACKING GLANDS: Chevron Type of grade suitable for service specified.
SPECIALS: Variations from standard cylinders can be supplied as specials and will be quoted on application.

CATALOGUE ON REQUEST

Engineering Division VICEROY West Toronto Canada
MANUFACTURING COMPANY LIMITED

New Fenwal Series 541 Controller is simple to install ...easy to maintain



The highly versatile Fenwal 541 temperature controller can be installed in minutes by an untrained person — and once installed will give long, reliable performance. Maintenance is easy too. All adjustments are external — even its snap switches can be replaced without disturbing the internal mechanism.

Fenwal's 541 is wear-compensated for greater reliability. All moving parts are in opposition — wear on one is automatically compensated for and the controller's accuracy remains unchanged. Housing meets applicable NEMA and JIC specifications, capillaries and bulbs are corrosion-proof stainless — swivel mounted to prevent breakage.

So versatile is the 541 that literally hundreds of adaptations can be made to order from stock! You can take your choice of temperature range, bulb styles, one or two circuit control, current ratings — even the housing color. You get a tailor-made controller at a competitive price!

Write Fenwal Inc., Factory Representative, Rousseau Controls, Ltd., 640 Decourcelle St., Montreal 30, P. Q., Canada. Tell us the controller you need for your operation — we'll do the rest.

Fenwal **Controls Temperature ...Precisely**

FORMSPRAG pioneers better gripping

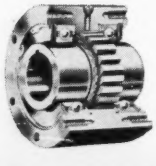
with

MODERN SPRAG TYPE *Clutches* *for*

★ **OVER RUNNING** (FREE WHEELING)

★ **BACKSTOPPING** ★ **INDEXING**

STANDARD AND SPECIAL SIZES } NO MEASURABLE BACKLASH LONG LIFE APPLICATIONS UNLIMITED



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RENOLD CHAINS CANADA LTD.

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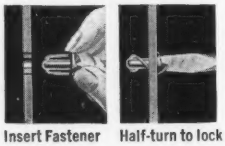
LONDON HAMILTON TORONTO
MONTREAL THREE RIVERS QUEBEC

This fastener works through thick and thin!

Spring-Lock works whether panel thicknesses run over or under specifications. Spring wire deflects automatically to handle greater or lesser thicknesses. Made in all-metal and plastic with steel insert, it can be adapted as a shelf-support, washer knob, bracket or any similar panel-mounted device.

Write for 40-page catalog on complete line, containing application examples, specifications, installation instructions and engineering data. Ask for samples, too.

Here's how Spring-Lock Works



Insert Fastener Half-turn to lock

INSTALLATION IS:

- **BLIND**
- **EASY:** No special tools needed
- **QUICK:** Half-turn locks it in place
- **SECURE:** Spring steel locks, resists vibration

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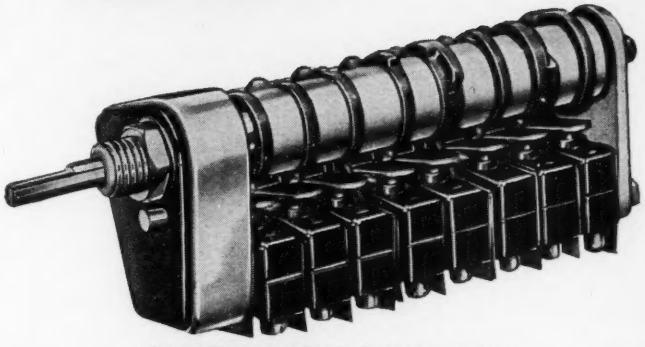
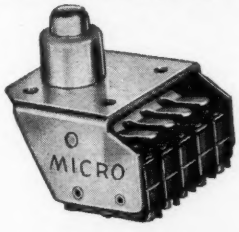
FOR MULTIPLE CIRCUIT CONTROL...



SUBMINIATURE ROTARY SELECTOR SWITCH

MICRO SWITCH rotary selector switches provide a means of switching two to eight different circuits with one small compact assembly. The switch consists of two to eight single-pole, double-throw subminiature basic switching units operated by cams on a common shaft. The cams are pre-set to operate the basic switches at 45° detents. Cams can be set to your specifications at the factory, permitting any combination of the switching units to be actuated in any position.

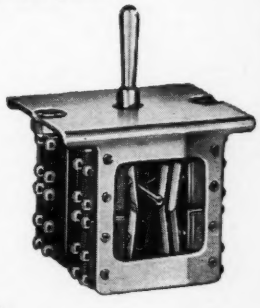


MULTIPLE CIRCUIT PANEL MOUNTING PUSH BUTTON SWITCH

Small, panel mounting manually operated push button switch containing two to fourteen basic switching units. Each unit may be wired either normally open or normally closed providing numerous combinations of "off" or "on" circuits in either depressed or released plunger positions.

SUBMINIATURE TOGGLE ASSEMBLY

An assembly of up to sixteen subminiature basic switches operated by a single bat handle. Eight switches can be operated with each direction of the toggle motion. This assembly makes an unusually efficient, compact, lightweight component . . . each of the subminiature switches is less than ¾" long and weighs less than 1/15 ounce.



ALTERNATE ACTION PUSH BUTTON SWITCH 82PB1-T-2

This maintained-contact push button switch offers one-button on-off control of two single-pole double-throw circuits. It requires only 1⅜" below its mounting panel. Alternate action is achieved by long-life nylon index cam. Switch provides double-pole, double-action and completes a cycle of operation every two-pushes of the button.

THERE'S A MICRO SWITCH PRECISION SWITCH FOR EVERY INDUSTRIAL REQUIREMENT

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MICRO SWITCH PRECISION SWITCHES

Editorial

Yet Another Canadian Achievement:

Following close on the Iroquois jet engine, unveiled at Orenda Engines Ltd. in August, comes Canada's first supersonic aircraft, the CF105 Arrow.

At some later date it is to be powered by the Iroquois but for the time being, it has been very wisely decided to use a tried engine, the Pratt & Whitney J75.

Design Engineering is unfortunately not at the moment in a position to give any worthwhile engineering data about this fine-looking aircraft. In the not-too-distant future, however, we hope to describe such technical aspects as the nose wheel undercarriage (made by Jarry-Hydraulics), the main undercarriage (made by Dowty Equipment of Canada Ltd.), the wing structure and power controls (designed by Avro engineers) and the magnesium-thorium canopy (made by Dominion Magnesium Ltd.).

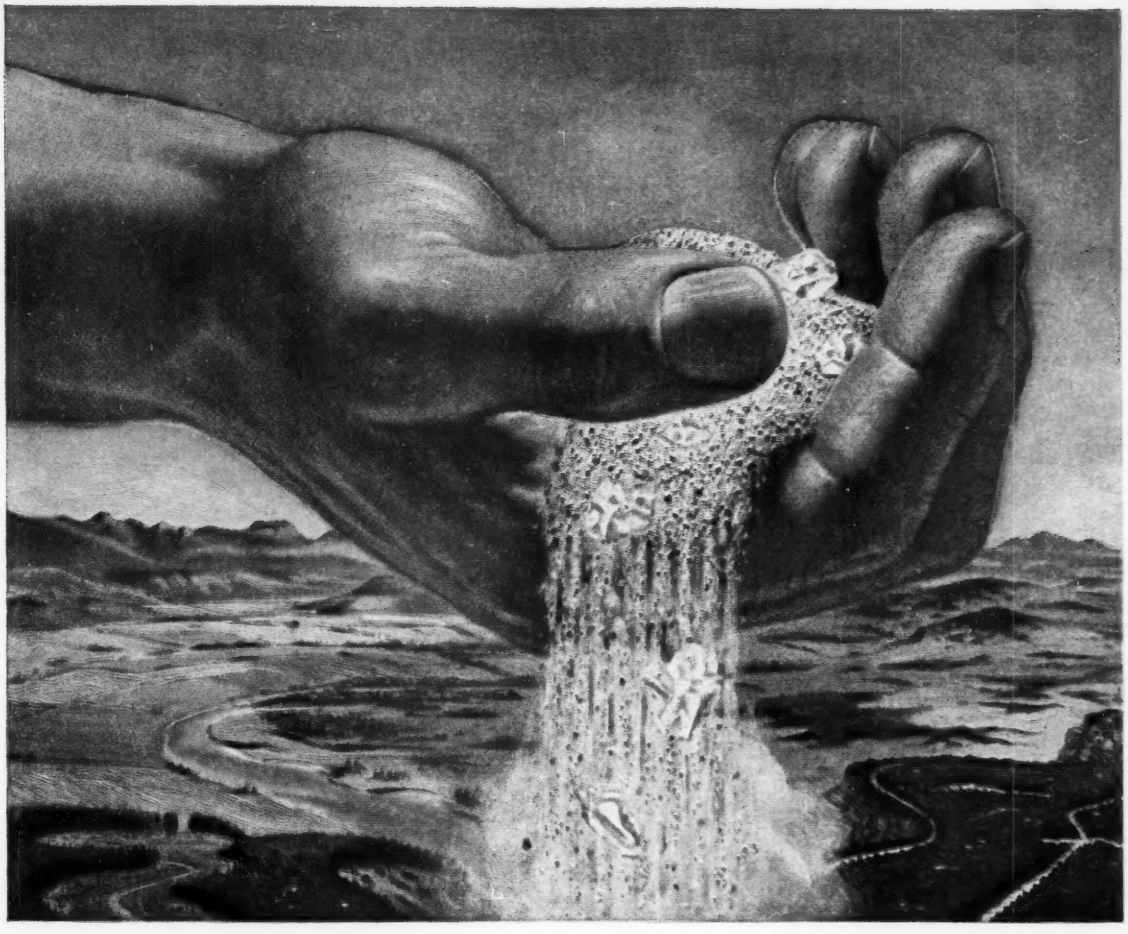
Readers of Design Engineering will already know, however, that the Arrow is a two-place, delta wing aircraft weighing about 34 tons with a speed of about 1,600 mph at altitude.

One rather amusing question that was put to Fred. T. Smye, president and general manager of Avro Aircraft Ltd., at the press gathering the evening before the unveiling was: "Do you think it will fly?" The questioner could not, of course, have had any idea of the amount of successful wind tunnel and free-flight testing that was carried out by CARDE and NACA. The day when aircraft could be designed on the back of an envelope (or even on the wall of the usual offices) has long since passed.

Rather in the same vein is the remark we once overheard when a new aircraft, with a nosewheel undercarriage, was wheeled out of the hangar for the first time. An onlooker, who had never before seen a tricycle undercarriage, exclaimed: "Yes, but what keeps the tail up?"

We should like to take this opportunity of congratulating the design personnel, under the able guidance of Jim Floyd, vice-president Engineering, Avro Aircraft Ltd., for an excellent job of work well done. They have certainly put Canada to the forefront with this fine machine!

William Morse.



It's There . . . But You Can't See It

YOU NEVER SEE the element silicon in nature. Yet it's hidden everywhere—in sand, rocks, clays and soils, and even in amethyst and many other semi-precious stones. In fact, of all the elements, silicon is second only to oxygen in abundance.

EXTENSIVE DEVELOPMENT has made silicon one of our most versatile and useful servants, but at the same time has followed nature's pattern of keeping it out of sight.

YOU CAN'T SEE the silicon in metals, but steel is stronger and more uniform when it contains small amounts of silicon. Larger amounts of silicon are added to steel used in generators and transformers, and in motors that bring Canadians the magic of electricity. Silicon adds to the usefulness of aluminum in many important applications.

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Because of their tapered design, Timken bearings take both radial and thrust loads in any combination. And full line contact between rollers and races gives Timken bearings extra load-carrying capacity.

With Timken bearings you get long life lubrication. Not just lubricated for "life", but lubricated yearly, or as conditions require to insure *longer* life. Fresh lubricant eliminates the slightest chance of gummy, sticky, jammed bearings.

Timken bearings minimize friction because they're designed to roll true. And they're manufactured with microscopic accuracy to conform to their design. We even make our own steel to control quality every step of the way.

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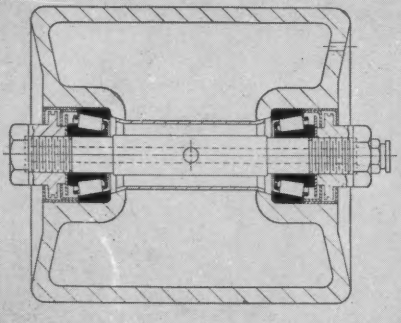
This symbol on a product means its bearings are the best.



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